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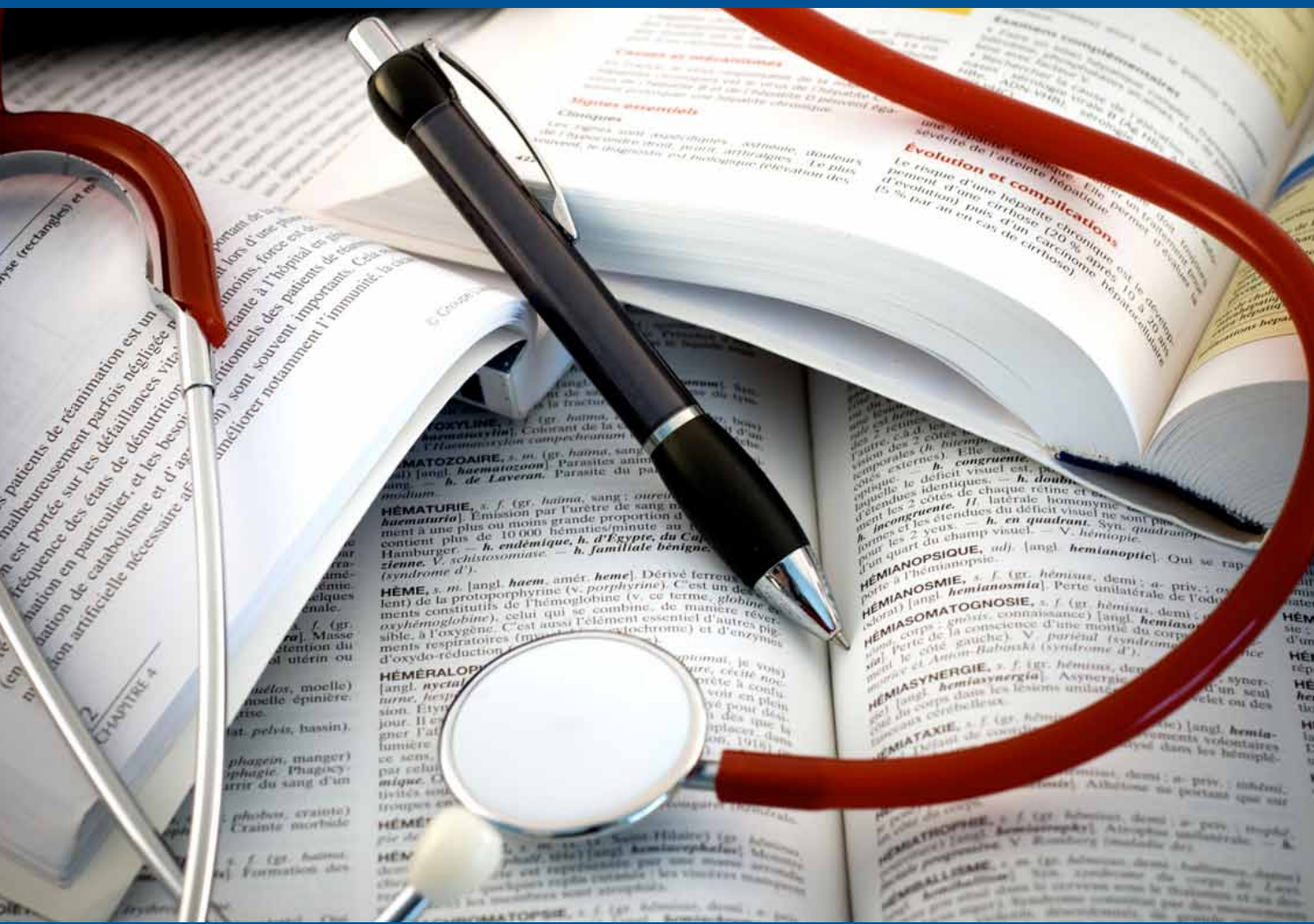


UPCPMT 2012
Sample Paper

UP CPMT

Medical Entrance Exam

Solved Paper 2012

Physics

1. The relation between Seebeck coefficient S and Peltier coefficient π is given by

(a) $S = \pi T$ (b) $S = \frac{\pi}{T}$

(c) $S = \frac{\pi^2}{T}$ (d) $S = \frac{\pi}{T^2}$

2. When a current of (2.5 ± 0.5) A flows through a wire, it develops a potential difference of (20 ± 1) V, the resistance of wire is

(a) $(8 \pm 2)\ \Omega$ (b) $(8 \pm 1.6)\ \Omega$

(c) $(8 \pm 1.5)\ \Omega$ (d) $(8 \pm 3)\ \Omega$

3. SI unit of intensity of wave is

(a) J m^{-2}s^{-1} (b) J m^{-1}s^{-1}

(c) W m^{-2} (d) J m^{-2}

4. How much time a light ray take to reach from earth to moon?

(a) 2 s (b) 1.4 s

(c) 8 min (d) 1.16 s

5. $[ML^{-1}T^{-1}\sigma^{-2}]$ is the dimensional formula of

(a) resistance (b) resistivity

(c) conductance (d) conductivity

6. A motor cyclist is riding north in still air at 36 km/s, the wind starts blowing westward with a velocity 18 km/s. The direction of apparent velocity is

(a) $\tan^{-1}\frac{1}{2}$ west of north

(b) $\tan^{-1}\frac{1}{2}$ north of west

(c) $\tan^{-1}\frac{1}{2}$ east of north

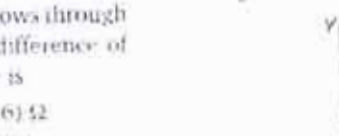
(d) $\tan^{-1}\frac{1}{2}$ north of east

7. The ratio of radii of two bubbles is 2 : 1. What is the ratio of excess pressures inside them?

(a) 1 : 2 (b) 1 : 4

(c) 2 : 1 (d) 4 : 1

8. Trajectories of two projectiles are shown in figure, let T_1 and T_2 be the periods and u_1 and u_2 are their speeds of projections, then



(a) $T_1 = T_2$ (b) $T_1 = T_2$

(c) $u_1 > u_2$ (d) $u_1 = u_2$

9. A small cone filled with water is revolved in a vertical circle of radius 4 m and does not fall down. What must be the maximum period of revolution?

(a) 4 s (b) 2 s

(c) 1 s (d) 6 s

10. In the stable equilibrium position, a body has

(a) maximum potential energy

(b) minimum potential energy

(c) minimum kinetic energy

(d) maximum kinetic energy

11. The capacitance of a spherical conductor with radius 1 m is

(a) 9×10^{-9} F (b) 10 μF

(c) 2.5×10^{-10} F (d) 1×10^{-6} F

12. Bernoulli's principle is based on the law of conservation of

(a) angular momentum

(b) linear momentum

(c) mass

(d) energy

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13. Two identical thin rings each of radius R are coaxially placed at a distance R. If mass of rings are m_1, m_2 respectively, then the work done in moving a mass m from centre of one ring to that of the other is

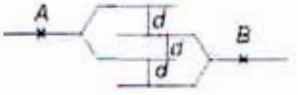
(a) $\frac{Gm}{m_2 R}(\sqrt{2}+1)\,m$

(b) $\frac{G\,m(m_1-m_2)}{\sqrt{2}R}\sqrt{2}-1$

(c) $\frac{G\,m\sqrt{2}}{R}(m_1+m_2)$

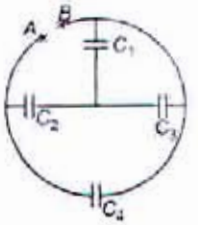
(d) zero

14. The equivalent capacity between points A and B in figure will be, while capacitance of each capacitor is $3\,\mu F$.



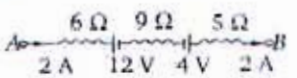
(a) $2\,\mu F$ (b) $4\,\mu F$
(c) $7\,\mu F$ (d) $9\,\mu F$

15. In the arrangement of capacitors shown in figure, each capacitor is of $9\,\mu F$, then the equivalent capacitance between the points A and B is



(a) $9\,\mu F$ (b) $18\,\mu F$
(c) $4.5\,\mu F$ (d) $15\,\mu F$

16. The potential difference between A and B in figure is

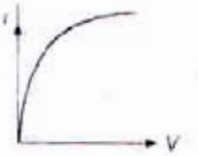


(a) 24 V
(b) 14 V
(c) 32 V
(d) 48 V

17. To draw the maximum current from a combination of cells, how should be the cells be grouped?

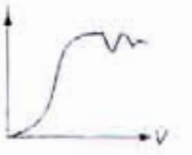
(a) Parallel
(b) Series
(c) Depends upon the relative values of internal and external resistances
(d) Mixed grouping

18. The variation between V has shown by graph for heating filament

(a)


(b)


(c)


(d)


19. For which colour, angle of deviation is minimum?

(a) Red (b) Yellow
(c) Violet (d) White

20. A thin equiconvex lens of refractive index $\frac{3}{2}$ and radius of curvature 30 cm is put in water (refractive index = $\frac{4}{3}$), its focal length is

(a) 0.15 m (b) 0.30 m
(c) 0.45 m (d) 1.20 m

21. The distance between the sun and the earth be r, then the angular momentum of the earth around the sun is proportional to

(a) $\sqrt{r}$ (b) $r^{3/2}$
(c) r (d) None of these

22. When a number of thermocouple are joined in series, then the thermo emf

(a) is decreased
(b) is increased
(c) becomes zero
(d) remains same

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23. To cool the car engines in radiators, water is used because it is having
(a) high value of specific heat
(b) high density
(c) low surface tension
(d) low density

24. An SHM is given by $y = 5[\sin(3\pi t) + \sqrt{3}\cos(3\pi t)]$.
What is the amplitude of the motion of y in metre?
(a) 10 (b) 20
(c) 1 (d) 5

25. The equations of displacement of two waves are $y_1 = 10 \sin(3\pi t + \pi/3)$ and $y_2 = 5[\sin 3\pi t + \sqrt{3}\cos 3\pi t]$
What is the ratio of their amplitude?
(a) 1 : 2
(b) 2 : 1
(c) 1 : 1
(d) None of the above

26. If v_γ, v_x and v_m are the speeds of γ-rays, X-rays and micro waves respectively in vacuum, then
(a) $v_\gamma > v_x > v_m$ (b) $v_\gamma < v_x < v_m$
(c) $v_\gamma > v_x < v_m$ (d) $v_\gamma = v_x = v_m$

27. The wavelength of X-rays is of the order of
(a) 1 m (b) 1 Å
(c) 1 μ (d) 1cm

28. What is the moment of inertia of solid sphere of density ρ and radius R about its diameter?
(a) $\frac{105}{176}R^5\rho$
(b) $\frac{105}{176}R^2\rho$
(c) $\frac{176}{105}R^5\rho$
(d) $\frac{176}{105}R^2\rho$

29. The radius of gyration of body depends upon
(a) shape and size of body
(b) nature of mass distribution of body
(c) choice of axis of rotation
(d) All are correct

30. A satellite is orbiting around the earth of height h above the earth surface. If the distance h increased, the time period of satellite will
(a) decrease
(b) increase
(c) remain unaffected
(d) becomes zero

31. If a simple pendulum is taken to a place where g decreases by 2%, then time period
(a) increase by 5% (b) increase by 1%
(c) increase by 2% (d) decrease by 5%

32. The motion of rod is
(a) periodic but not oscillatory
(b) oscillatory but not SHM
(c) linear harmonic motion
(d) angular harmonic oscillatory

33. Among the following equations, which one represents the spherical progressive wave
(a) $y = r\sin\omega t$
(b) $y = \frac{a}{r}\sin(\omega t - kx)$
(c) $y = \frac{a}{\sqrt{r}}\sin(\omega t - kx)$
(d) $y = \sqrt{\frac{a}{r}}\sin(\omega t - kx)$

34. If the shift in a star light is towards red end, then
(a) the star is approaching the earth
(b) the star receding from the earth
(c) the apparent frequency is lesser than actual
(d) Both (b) and (c)

35. The velocity of sound is affected by change in
(a) temperature
(b) medium
(c) pressure
(d) Both (a) and (b)

36. A solid of density D is floating in a liquid of density d. If V is the volume of solid submerged in the liquid and V' is the total volume of the solid, then V/V' is equal to
(a) $\frac{d}{D}$ (b) $\frac{D}{d}$
(c) $\frac{D}{d+D}$ (d) $\frac{D-d}{D}$

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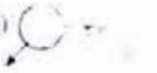
37. To get the maximum height, a ball must be thrown as

(a) 

(b) 

(c) 

(d) None of these

38. A body cools from 60°C to 50°C in 10 min. If room temperature is 95°C of body at the end of next 10 min, will be

(a) 38.5°C (b) 40°C

(c) 45°C (d) 42.85°C

39. If C_s is the velocity of sound in air and C is the rms value, then

(a) $C_s < C$

(b) $C_s = C$

(c) $C_s = C\left[\frac{\gamma}{3}\right]^{1/2}$

(d) None of the above

40. One mole of an ideal gas is heated at a constant pressure of 1 atm from 0°C to 100°C. Work done by the gas is

(a) 8.31×10^{3} J

(b) 8.31×10^{-3} J

(c) 8.31×10^{-2} J

(d) 8.31×10^{2} J

41 The efficiency of a Carnot engine is 60%. If the temperature of source is 127°C. The sink must be maintained at

(a) 113 K

(b) + 113°C

(c) - 113°C

(d) – 113 K

42. Equal charge q each are placed at the vertices A and B of an equilateral triangle ABC of side a. The magnitude of electric intensity at the point C is

(a) $\frac{q}{4\pi\varepsilon_0 a^2}$ (b) $\frac{\sqrt{2}q}{4\pi\varepsilon_0 a^2}$

(c) $\frac{\sqrt{3}q}{4\pi\varepsilon_0 a^2}$ (d) $\frac{2q}{4\pi\varepsilon_0 a^2}$

43. A non-conducting solid sphere of radius R is uniformly charged. The magnitude of electric field due to sphere at a distance r from its centre

(a) increase as r increases for $r > R$

(b) decreases as r increases $0 < r < \infty$

(c) decrease as r increases $R < r < \infty$

(d) Both (a) and (c)

44. In producing chlorine through electrolysis 100 kW power at 125 V is being consumed. How much chlorine per minute is liberated?

(ECE of chlorine is 0.376×10^{-6} kg C^{-1})

(a) 17.6×10^{-3} kg

(b) 16.6×10^{-3} kg

(c) 15.6×10^{-3} kg

(d) None of the above

45. Two bulbs when connected in parallel to a source take 60 W each, the total power consumed, when they are connected in series with the same source is

(a) 15 W (b) 30 W

(c) 60 W (d) 120 W

46. In a voltaic cell, 5 g of zinc is consumed, we will get how many ampere hour (ECE of zinc is 3.387×10^{-7} kg C^{-1})?

(a) 2.05 (b) 8.2

(c) 4.1 (d) $5 \times 3.138 \times 10$

47. The magnetic moment of a electron orbiting in a circular orbit of radius r with a speed v is equal to

(a) $\frac{evr}{2}$ (b) evr

(c) $\frac{ev}{2r}$ (d) None of these

48. The magnetic flux linked with a circuit of resistance 100 Ω increases from 10 to 60 Wb. The amount of induced charge that flows in the circuit is (in coulomb)

(a) 0.5

(b) 5

(c) 50

(d) 100

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49. A dip needle vibrates in a vertical plane perpendicular to magnetic meridian. The time of vibration is found to be 2$\sqrt{5}$, the same needle is then allowed to vibrate in the horizontal plane and the time period is again found to be 2$\sqrt{5}$. Then, the angle of dip is
(a) 0° (b) 30° (c) 45° (d) 90°

50. At curie point, a ferromagnetic material becomes
(a) non-magnetic
(b) diamagnetic
(c) paramagnetic
(d) strongly ferromagnetic

Chemistry

1. Shape and hybridisation of SO_2 are
(a) V shape, sp
(b) triangular planar sp^2
(c) V shape, sp^2
(d) tetrahedral sp^3

2. The solid product formed on strong heating of $AgNO_3$ is
(a) silver oxide (b) silver nitrate
(c) silver metal (d) silver nitride

3. Which one of the following liberate bromine when reacted with KBr?
(a) Iodine (b) Chlorine
(c) Sulphur (d) Carbon

4. Malachite is an ore of
(a) copper (b) zinc
(c) potassium (d) silver

5. C_3H_2 molecule is
(a) linear (b) angular
(c) trigonal planar (d) pyramidal

6. Which one of the following statements regarding ammonia is not correct?
(a) NH_3 has sp^2 hybridization
(b) NH_3 acts as a Lewis base
(c) NH_3 gas is highly soluble in water
(d) NH_3 is pyramidal in shape

7. Reason of passivity of iron is
(a) Fe_2O_3 (b) Fe_3O_4
(c) FeO (d) $Fe_2O_3 \cdot 3H_2O$

8. Of the following compounds, the most acidic is
(a) As_2O_5 (b) Sb_2O_5
(c) Bi_2O_5 (d) N_2O_5

9. The electronegativity of the following elements increases in the order
(a) C < N < Si < P
(b) N < Si < C < P
(c) Si < P < C < N
(d) P < Si < N < C

10. Which one of the following options is correct?
(a) $4NH_3 + 5O_2 \longrightarrow 4NO + 6H_2O$
(b) $4NO + 3O_2 \longrightarrow 2N_2O_5$
(c) $NH_4NO_3 \xrightarrow{\Delta} N_2O + 2H_2O$
(d) $2NO_2 \xrightarrow[\text{Cool}]{\text{Heat}} N_2O_4$

11. Which one of the following is least basic?
(a) NF_3 (b) NCl_3
(c) NBr_3 (d) NI_3

12. 10 g of hydrogen and 64 g of oxygen were kept in a steel vessel and exploded. Amount of water produced in this reaction will be
(a) 2 mol (b) 4 mol
(c) 8 mol (d) 10 mol

13. CO is isoelectronic with
(a) CN (b) N_2
(c) N_2^+ (d) NO

14. Oxidation number of Cr in $Cr_2O_7^{2-}$ is
(a) + 2 (b) + 4
(c) + 6 (d) + 7

15. Radioactive isotope of hydrogen is
(a) uranium (b) deuterium
(c) tritium (d) None of these

16. Which one of the following has incomplete octet?
(a) NH_3 (b) BCl_3
(c) CCl_4 (d) PCl_5

17. Which one of the following is wrong?
(a) $FeSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$ – Mohr salt
(b) $Na_2CO_3 \cdot 10H_2O$ – washing soda
(c) $FeSO_4 \cdot 7H_2O$ – green vitriol
(d) $CaSO_4 \cdot 2H_2O$ – plaster of Paris

18. Which one of the following is most basic?
(a) $Mg(OH)_2$ (b) $Ca(OH)_2$
(c) $Sr(OH)_2$ (d) $Ba(OH)_2$

19. Gypsum is added to cement to
(a) decrease the rate of setting of cement
(b) increase the rate of setting of cement
(c) bind the particles of calcium silicate
(d) facilitate the formation of colloidal gel

20. The order of osmotic pressure of three equimolar aqueous solutions of $CaCl_2$, NaCl and $C_6H_{12}O_6$ (glucose) is
(a) $CaCl_2 > NaCl > C_6H_{12}O_6$
(b) $NaCl > CaCl_2 > C_6H_{12}O_6$
(c) $C_6H_{12}O_6 > CaCl_2 > NaCl$
(d) $C_6H_{12}O_6 > NaCl > CaCl_2$

21. Among water molecules, the type of bond present between H and O is
(a) hydrogen bond (b) electrovalent bond
(c) coordinate bond (d) covalent bond

22. In aluminothermic process, aluminium acts as
(a) a reducing agent
(b) an oxidising agent
(c) a complex forming agent
(d) a dehydrating agent

23. H_3BO_3 is acidic because it
(a) liberates H^+ ions (b) accepts OH^- ions
(c) Both (a) and (b) (d) None of these

24. Which one of the following statements is wrong?
(a) In homogeneous catalysis, reactants, products and catalyst are in same phase
(b) A catalyst accelerates the rate of reaction by bringing down the energy of activation
(c) A catalyst alters the equilibrium constant
(d) The mass of catalyst remains same after reaction

25. Two gases *A* and *B* having the same volume diffuse through a porous partition in 20 s and 10 s respectively. The molecular mass of *A* is 49 u. Molecular mass of *B* will be
(a) 25.00 u (b) 50.00 u
(c) 12.25 u (d) 6.50 u

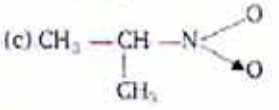
26. The heats of neutralisation of four acids *A*, *B*, *C* and *D* when neutralised against a common base are 13.7, 9.4, 11.2, and 12.4 kcal respectively. The weakest and strongest among these acids are
(a) *B* and *A* respectively
(b) *A* and *C* respectively
(c) *C* and *D* respectively
(d) *A* and *B* respectively

27. Phosphorus pentachloride dissociates as follows in a closed reaction vessel,
$$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$$
If total pressure at equilibrium of the reaction mixture is *p* and degree of dissociation of PCl_5 is *x*, the partial pressure of PCl_5 will be
(a) $\left(\frac{x}{x+1}\right)p$ (b) $\left(\frac{2x}{1-x}\right)p$
(c) $\left(\frac{x}{x-1}\right)p$ (d) $\left(\frac{x}{1-x}\right)p$

28. The equilibrium constant for the reaction, $aA + bB \rightleftharpoons cC + dD$ is *K*, then the equilibrium constant for the reaction, $naA + nbB \rightleftharpoons ncC + ndD$ will be
(a) K (b) K^n
(c) $\frac{1}{K^n}$ (d) $\frac{1}{K^{n-1}}$

29. Which one of the following does not reduce Benedict's solution?
(a) Glucose (b) Sucrose
(c) Aldehyde (d) Fructose

30. Nitration of aniline also gives *m*-nitroaniline in strong acidic medium because
(a) in electrophilic substitution, reaction amino group is *meta*-directive
(b) in spite of substituents, nitro group always goes to *m*-position
(c) in strong acidic medium, aniline present as anilinium ion
(d) None of the above

31. Which one of the following is not a nitro derivative?
(a) $C_6H_5NO_2$
(b) CH_3CH_2ONO
(c) 
(d) $C_6H_4(OH)NO_2$

32. An organic compound of molecular formula $C_4H_{10}O$ does not react with sodium. With excess of HI, it gives only one type of alkyl halide. The compound is
(a) ethoxy ethane
(b) 1-butanol
(c) 1-methoxy propane
(d) 2-methoxy propane

33. Formic acid and acetic acid are distinguished by
(a) $NaHCO_3$ (b) $FeCl_3$
(c) Victor Meyer test (d) Tollen's reagent

34. Select the detergent that is used to prepare cosmetics
(a) DDBS
(b) polyethylene glycol
(c) cetyltrimethyl ammonium chloride
(d) LAS

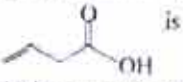
35. Of the following which one is classified as polyester polymer?
(a) Nylon-66 (b) Terylene
(c) Bakelite (d) Melamine

36. Ether on reacting with P_2S_5 form
(a) diethyl sulphide (b) thioalcohol
(c) thioether (d) thioaldehyde

37. Sodium phenoxide reacts with CO_2 at 400 K and 4.7 atm pressure to give
(a) catechol
(b) salicylaldehyde
(c) sodium salicylate
(d) benzoic acid

38. The raw material for Raschig process is
(a) chlorobenzene (b) phenol
(c) benzene (d) anisol

39. Consider the following carbocations
I. Cl_3C^+ II. Cl_2CH^+
III. $ClCH_2^+$ IV. $\overset{+}{C}H_3$
The stability sequence follows the order
(a) IV < I < III < II (b) I < II < III < IV
(c) II < III < IV < I (d) III < I < II < IV

40. The IUPAC name of  is
(a) but-3-enoic acid (b) but-1-enoic acid
(c) pent-4-enoic acid (d) prop-2-enoic acid

41. 0.833 mole of a carbohydrate with empirical formula CH_2O, has 10g of hydrogen. Molecular formula of carbohydrate is
(a) $C_3H_6O_3$ (b) $C_6H_{12}O_6$
(c) $C_5H_{10}O_5$ (d) $C_4H_8O_4$

42. Toluene by Etard's reaction gives
(a) *ortho*-cresol (b) boric acid
(c) benzyl alcohol (d) benzaldehyde

43. Pick out the unsaturated fatty acid from the following
(a) Stearic acid (b) Lauric acid
(c) Oleic acid (d) Palmitic acid

44. What is the product formed when acetylene reacts with hypochlorous acid?
(a) CH_3COCl (b) $ClCH_2CHO$
(c) Cl_2CHCHO (d) $ClCH_2COOH$

45. Benzamide on reaction with $POCl_3$ gives
(a) aniline (b) chlorobenzene
(c) phenylamine (d) phenyl nitrile

46. The dissociation constant of a substituted benzoic acid at 25°C is 1.0×10^{-4}. The pH of 0.01 M solution of its sodium salt is
(a) 7 (b) 8
(c) 9 (d) 10

47. How many grams of sulphuric acid is to be dissolved to prepare 200 mL aqueous solution having concentration of $[H_3O^+]$ ions 1 M at 25°C assuming ionic? [H = 1, O = 16, S = 32g mol^{-1}]
(a) 4.9 g (b) 19.6 g
(c) 9.8 g (d) 0.98 g

48. Which one of the following electronic configuration corresponds to the highest value of ionisation potential?
(a) [Xe] $6s^2$ (b) [Ar] $4s^2\ 3d^{10}$
(c) $1s^2$ (d) [Rn] $7s^2 6d^1\ 5f^{14}$

49. The reaction, $2H_2O_2 \longrightarrow 2H_2O + O_2$; shows that H_2O_2
(a) is decomposed
(b) acts as oxidising agent
(c) acts as reducing agent
(d) None of the above

50. Given: (i) $C(s) + O_2(g) \rightarrow CO_2(g)$,
$\Delta H = -94.0$ kcal
(ii) $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l)$;
$\Delta H = -68.4$ kcal
(iii) $CH_4(g) + O_2(g) \longrightarrow CO_2(g) + 2H_2O(l)$;
$\Delta H = -212.4$ kcal
The heat of formation of CH_4 is
(a) –18.4 kcal (b) + 18.4 kcal
(c) –443.2 kcal (d) + 443.2 kcal

Biology

Zoology

1. Glochidium larva is absent in
(a) *Unio* (b) *Pinctada*
(c) *Sepia* (d) None of these

2. Nematoblast found on
(a) ectoderm (b) endoderm
(c) Both (a) and (b) (d) mesoderm

3. What type of teeth are found in man?
(a) Acrodont (b) Thecodont
(c) Polyphyodont (d) Monophyodont

4. Radius is a bone found in
(a) arms (b) legs
(c) pelvic girdle (d) None of these

5. The enzyme carbonic anhydrase takes part in CO_2 transport is found in
(a) WBCs (b) lymphocytes
(c) RBCs (d) monocytes

6. Which of the following is not a part of brain stem?
(a) Cerebrum
(b) Pons varolii
(c) Medulla oblongata
(d) Corpora quadrigemina

7. The correct order of vertebrae is
(a) cervical, thoracic, lumber, sacral
(b) thoracic, lumber, cervical, sacral
(c) sacral, cervical, lumber, thoracic
(d) lumber, thoracic, sacral, cervical

8. Which of the following statement characterises the depolarization state of neuron?
(a) Na^+ gets inside through ion channels
(b) Na^+ gets outside through channels
(c) K^+ channels remain open
(d) All of the above

9. Which of the following is not WBC?
(a) Thrombocyte (b) Lymphocytes
(c) Eosinophils (d) Basophils

10. The maximum amount of WBCs found in blood is
(a) monocytes (b) basophil
(c) neutrophils (d) eosinophils

11. Pulmonary vein has the characteristic that it carry blood from
(a) left atrium to lung
(b) right atrium to lung
(c) lung to right atrium
(d) lung to left atrium

12. What is the value of systolic and diastolic pressure in human?
(a) 150/180 (b) 120/80
(c) 100/150 (d) 50/60

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13. Which of the following hormones is secreted by placenta?
(a) Testosterone (b) HCG
(c) Melatonin (d) Glucagon

14. Which portion of human sperm contain enzymes?
(a) Neck (b) Middle piece
(c) Tail (d) Acrosome

15. What type of cleavage is found in frog?
(a) Discoidal
(b) Holoblastic unequal
(c) Holoblastic equal
(d) Superficial

16. Permanent contraception in human male is called
(a) tubectomy (b) disphragen
(c) vasectomy (d) None of these

17. Malpighian tubules are organs of excretion in
(a) Platyhelminthes (b) annelids
(c) spiders (d) arthropods

18. Which of the following form thick filament of muscles?
(a) Actin (b) Troponin
(c) Tropomyosin (d) Myosin

19. Hypothyroidism caused ..... in human
(a) cretinism
(b) Grave's disease
(c) Plummer's disease
(d) None of the above

20. What type of muscles are found in heart?
(a) Skeletal (b) Cardiac muscles
(c) Non-striated (d) All of these

21. What are the locomatory organs in Echinoderms?
(a) Mantle (b) Tube feet
(c) Ommatidia (d) Pedicullariae

22. Which type of scales are found in chondrichthes?
(a) Ganoid (b) Cycloid
(c) Placoid (d) Ctenoid

23. Which of the following was not used by Miller in his experiment?
(a) O_2 (b) CH_4
(c) NH_3 (d) H_2O

24. Which one of the following characters provide a strong evidence in support of organic ovulation?
(a) Gill clefts in vertebrate embryo
(b) wings in insects, birds and bats
(c) jointed legs in arthropods and mammals
(d) excretory organ of earthworm and frog

25. During emergency which of the following hormone is secreted?
(a) Aldosterone (b) Thyroxine
(c) Adrenalin (d) Calcitonin

26. In cockroach, larval and nymphal characters are maintained by
(a) ecdysone (b) salivary glands
(c) parotid gland (d) juvenile hormone

27. In rabbit, end of a long bone is connected in another by
(a) tendon (b) ligaments
(c) muscle (d) cartilage

28. Animals having a built in thermostat to maintain constant body temperature are known as
(a) biothermic (b) poikilothermic
(c) oligothermic (d) homeothermic

29. The vitamin which is essential for blood clotting is
(a) vitamin-A (b) vitamin-B
(c) vitamin-C (d) vitamin-K

30. In frog heart, there are cardiac muscles which consists of fibres called
(a) Purkinje fibres (b) myonemes
(c) telodendria (d) columnae carne

31. Mesonephric kidney are
(a) excretory organs of insects
(b) excretory organs of frog
(c) respiratory organs of insects
(d) endocrine glands of insects

32. Which of the following provides most evident proof of evolution?
(a) Fossils (b) Morphology
(c) Embryo (d) Vestigial organs

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33. In Mollusca, eye is present over a stalk, called
(a) ostracum (b) operculum
(c) ommatophores (d) osphradium

34. Among the following, colonial insects are
(a) locusts (b) mosquitoes
(c) white ants (d) bed bug

35. In *Ascaris*, the coelom is
(a) schizocoelom (b) pseudocoelom
(c) true coelom (d) haemocoelom

36. Turbellarians are free living
(a) nematodes (b) cestodes
(c) flat worms (d) trematodes

37. In rabbit, head of epididymis present at the head of the testis is called
(a) vas deferens (b) cauda epididymis
(c) gubernaculum (d) caput epididymis

38. In blood, CO_2 in transported majorly as
(a) sodium carbonate
(b) carboxyhaemoglobin
(c) bicarbonate
(d) CO_2 as such

39. Kupffer cells are present in
(a) liver (b) small intestine
(c) pancreas (d) thyroid gland

40. Contractile vacuole in protozoan *Amoeba* is meant for
(a) respiration (b) excretion
(c) locomotion (d) osmoregulation

41. Which of the following is important for muscle contraction and nerve impulse transmission?
(a) Ca^{2+} ions (b) Mg^{2+} ions
(c) Both (a) and (b) (d) Fe^{2+} ions

42. Which one is component of ornithine cycle?
(a) Ornithine, citrulline and alanine
(b) Ornithine, citrulline and arginine
(c) Amino acid are not used fumaric acid
(d) Ornithine, citrulline and fumaric acid

43. Which of the following is not vestigial in man?
(a) Tail vertebrae
(b) Nails
(c) Nictitating membrane
(d) Vermiform appendix

44. Small fish get stuck near the bottom of a shark and derives its nutrition from it. This kind of association is called as
(a) antibiosis
(b) commensalism
(c) predation
(d) parasitism

45. Which of the following is the largest gland in an adult man?
(a) Thymus (b) Liver
(c) Thyroid (d) Pancreas

46. Rh factor is present in
(a) all vertebrates
(b) all mammals
(c) all reptiles
(d) man and rhesus monkey only

47. Which is correctly matched?
(a) Apiculture — Honey bee
(b) Pisciculture — Silk moth
(c) Sericulture — Fish
(d) Aquaculture — Mosquito

48. The intermediate host of *Schistosoma* is
(a) snail (b) mosquito
(c) housefly (d) sheep

49. Which of the following cell type is capable of giving rise to other cell types in sponges?
(a) Thesocytes (b) Pinacocytes
(c) Cnidocytes (d) Archaeocytes

50. Salivation in man is under the control of
(a) medulla oblongata
(b) mesencephalon
(c) hypothalamus
(d) cerebellum

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Botany

1. Chitin is constituent of fungus cell wall. Its hydrolysis yield
   (a) cellulose
   (b) N-acetyl glucosamine
   (c) hemicellulose
   (d) N-acetyl muramic acid

2. Which of the following is a carbohydrate having β repeated units?
   (a) Pectin (b) Lignin
   (c) Both (a) and (b) (d) Cellulose

3. Which one of the following is dead but work efficiently?
   (a) Sieve tube (b) companion cells
   (c) Vessels (d) Both (b) and (c)

4. The plant tissue having aquatic adaptation is
   (a) collenchyma
   (b) sclerenchyma
   (c) aerenchyma
   (d) parenchyma

5. The energy currency of the cell is
   (a) AMP (b) GTP
   (c) $NADPH_2$ (d) ATP

6. The plants commonly called vascular cryptogams are
   (a) bryophytes (b) pteridophytes
   (c) algae (d) angiosperms

7. The dominant generation in pteridophytes is
   (a) sporophytic (b) gametophytic
   (c) zygotic (d) None of these

8. Which of the following represents the male gamete?
   (a) Endosperm (b) Synergids
   (c) Pollen grain (d) Antipodals

9. Which of the following is common in chloroplast and mitochondria?
   (a) Both are not a component of endomembrane system
   (b) Both contain small amount of DNA
   (c) Both are found in animal cells
   (d) Both involved in respiration

10. What are plasmids commonly used in genetic engineering?
    (a) Extrachromosomal DNA
    (b) Nuclear DNA
    (c) Membrane bound organelle
    (d) DNA attached to mitochondria

11. If by grazing the grasses benefit the term for this is
    (a) commonsalism (b) predation
    (c) mutualism (d) ammesalism

12. The cytoskeleton in plant cell is composed of
    (a) microtubules
    (b) microfilaments
    (c) intermediate filaments
    (d) All of the above

13. The food is stored in plants in form of
    (a) starch (b) inulin
    (c) lactose (d) maltose

14. Photorespiration is a characteristic feature of plants having
    (a) C_3-cycle
    (b) C_4-cycle
    (c) aerobic respiration
    (d) None of the above

15. In perenial plants the food is stored mainly in
    (a) roots (b) stem
    (c) leaves (d) fruit

16. From red, blue, violet, which one is most efficient colour for photosynthesis?
    (a) Red (b) blue
    (c) violet (d) None of these

17. In opening and closing of stomata when K^+ is influx then there is efflux of
    (a) Na^+ (b) K^+
    (c) Cl^- (d) H^+

18. In which stage of mitosis chromosome arrange on equatorial plate?
    (a) Prophase
    (b) Metaphase
    (c) Anaphase
    (d) Telophase

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19. The strands of double helical DNA are antiparallel due to
(a) phosphodiester bonds
(b) hydrogen bonds
(c) ionic bonds
(d) coordinate bonds

20. Eutrophication is a phenomenon occur due to
(a) mixing of nutrients to water bodies
(b) high concentration of CO_2 in air
(c) high concentration of Hg in fish
(d) high concentration of NO_2 and SO_2 in rain water

21. Nitrifying bacteria are
(a) autotrophs (b) chemoautotrophs
(c) heterotrophs (d) phototrophs

22. Which of the following gas is not responsible for global warming?
(a) CO_2 (b) CH_4
(c) NO_x (d) N_2

23. The decomposed organic matter is commonly called
(a) phenoles (b) callose
(c) strach (d) humus

24. Gram negative bacteria are resistant due to presence of
(a) teichoic acid
(b) lipopolysaccharides
(c) chitin
(d) cellulose

25. In bryophyte's the sporophytic phase is represented by
(a) spores (b) antheridium
(c) spore mother cell (d) egg

26. The coralloid root of *Cycas* has *Anabaena* (B G A), this type of association is called
(a) commensalism (b) parasitic
(c) symbiotic (d) antibiosis

27. Which type of fruit is found in pear?
(a) Berry (b) Drupe
(c) Lomentum (d) Pome

28. *Zingeber officinale* is a
(a) leaf (b) modified stem
(c) root (d) modified root

29. Which one of the following does not cause variation?
(a) Meiosis (b) Cloning
(c) Recombination (d) Mutation

30. One among the following is a micronutrient?
(a) Mg (b) Ca
(c) S (d) Cu

31. Introduction of new species in ecosystem leads to
(a) symbiosis
(b) better development
(c) competition for resources
(d) None of the above

32. When heat energy absorb in system, it is called
(a) endergonic (b) endothermic
(c) exothermic (d) Both (a) and (b)

33. Which of the following is a coenzyme?
(a) NAD^+ (b) Protein
(c) Cu^{++} (d) None of these

34. Binomial system of nomenclature was given by
(a) Julian Huxley
(b) Bentham and Hooker
(c) Linnaeus
(d) Casper Bauhin

35. The vacuole is lined by a membrane called
(a) tonoplast (b) jacket
(c) cell membrane (d) tonoplasm

36. Agar-agar is obtained from
(a) *Chlorella* (b) *Spirogyra*
(c) *Ulothrix* (d) *Gelidium*

37. Duramen is present in
(a) inner region of secondary wood
(b) part of sap wood
(c) outer region of secondary wood
(d) region of pericycle

38. Which is always present in photochemical smog?
(a) O_3 (b) CO_2
(c) SO_2 (d) CH_4

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39. The soil which is transported by wind is known as
(a) colluvial (b) eolian
(c) aluvial (d) glacial soil

40. Lichen is the pioneer vegetation of which succession?
(a) Hydrosere (b) Lithosere
(c) Psammosere (d) Xerosere

41. In *Pinus*, male cone bears a large number of
(a) ligules (b) anthers
(c) micro-sporophylls (d) mega-sporophylls

42. Which of the following plant product is the hardest?
(a) Lignin (b) Cutin
(c) Suberin (d) sporopollenin

43. 'Clamp connections' are observed in
(a) Basidiomycetes (b) Zygomycetes
(c) Ascomycetes (d) Oomycetes

44. Most accepted theory for ascent of sap is
(a) capaillarity theory
(b) root pressure theory
(c) pulsation theory
(d) transpiration pull

45. Which of the following is not the feature of gymnosperms?
(a) Parallel venation
(b) Perennial plants
(c) Distinct branches (long and short branches)
(d) Xylem with vessels

46. The presence of diversity at the junction of territories of two different habitats is known as
(a) bottle neck effect
(b) edge effect
(c) junction effect
(d) Pasteur effect

47. Energy transferred from one trophic level to another is
(a) 5% (b) 10%
(c) 15% (d) 20%

48. L-shaped chromosomes are also called
(a) acrocentric
(b) telocentric
(c) sub-metacentric
(d) None of the above

49. A bacterium divides after every 35 min., if a culture containing 10^5 cells per ml. is grown, then cell concentration per ml. after 175 min will be
(a) 175×10^5 (b) 125×10^5
(c) 48×10^5 (d) 32×10^5

50. Biological concept of species is mainly based on
(a) reproductive isolation
(b) morphological features only
(c) methods of reproduction only
(d) morphology and methods of reproduction

हिन्दी

1. 'सनाद' शब्द में कौन सा उपसर्ग है?
(a) स (b) सम्
(c) सु (d) सत

2. 'जागृति' शब्द में कौन-सा प्रत्यय है?
(a) इ (b) ति
(c) इति (d) इत

3. निम्नलिखित में से कौन-सा सन्धि विच्छेद सही है?
(a) उप + इन्द्र (b) दैव + ईश
(c) चन्द्र + उदय (d) ये सभी

4. 'आपबीती' शब्द में कौन सा समास है?
(a) द्विगु (b) द्वन्द्व
(c) तत्पुरुष (d) अव्ययीभाव

5. 'पतित' का पर्यायवाची शब्द है
(a) अपराधी (b) कपूत
(c) पापी (d) म्लेच्छ

6. 'हीनता' का विलोमार्थक शब्द है
(a) दासता (b) उत्साह
(c) इच्छा (d) सबलता

7. जो बाँटा न जा सके
(a) अपूर्ण (b) अतुलनीय
(c) अपरिहार्य (d) अभाज्य

8. दुकाल का उपसर्ग है
(a) दूर (b) दुस
(c) दु (d) दुक

9. 'क्षत्रिय' का प्रत्यय है
(a) इय (b) इगा
(c) त्रिय (d) अनीय

10. 'निर्जन' का सन्धि विच्छेद है
(a) नि + रजन (b) निर + जन
(c) नी + जन (d) नि + जन

11. 'एक पन्थ दो काज' कहावत का अर्थ है
(a) एक चीज के अनेक चाहने वाले
(b) एक साथ दो काम होना
(c) एक रास्ते में दो काम करना
(d) उपरोक्त में से कोई नहीं

12. 'दोनों हाथ में लड्डू' मुहावरे का अर्थ है
(a) किसी भोज में शरीक होना
(b) दोनों हाथों में मोतीचूर के लड्डू रखना
(c) दो तरफा लाभ
(d) उपरोक्त सभी

13. समानान्तर शब्द का सन्धि विच्छेद है
(a) समाना + अन्तर (b) समान + अन्तर
(c) समा + नान्तर (d) समान + अन्तर

14. 'उनचास' में प्रयुक्त उपसर्ग है
(a) उन
(b) उन
(c) उनच
(d) उ

15. सीमा पर __________ तैनात है।
(a) सेना (b) दुश्मन
(c) डाकू (d) पुलिस

16. इज्जत उतारना
(a) लालची होना
(b) ठण्डी सांस खींचना
(c) व्यर्थ बकवास करना
(d) अपमानित करना

17. विनय का पर्यायवाची शब्द है
(a) बहादुर (b) सुशील
(c) भक्त (d) विज्ञानी

18. 'अन्धे की लकड़ी' का अर्थ है
(a) बहुत कमजोर होना
(b) एकमात्र सहारा
(c) बिल्कुल असमर्थ होना
(d) किसी अन्धे व्यक्ति की छड़ी

19. 'चकमा देना' मुहावरे का अर्थ है
(a) परेशान करना (b) परेशानी में डालना
(c) ठगना (d) इनमें से कोई नहीं

20. वृक्षों के बड़े समूह को कहते है
(a) अवली (b) आगार
(c) अम्बार (d) वन

21. नीचे दिए गए शब्द समूह के लिए सही शब्द का चयन कीजिए।
जिसकी पत्नी मर गई हो
(a) विदुर (b) विधवा
(c) विधुर (d) विधाता

22. नीचे दिए गए शब्द समूह के लिए सही शब्द का चयन कीजिए।
किए गए अहसानों को जानने, समझने व मानने वाला
(a) सुविज्ञ (b) कृतज्ञ
(c) कृतघ्न (d) विज्ञ

23. नीचे दिए गए शब्द समूह के लिए सही शब्द चुनिए।
एक ही माँ की कोख से जन्मा
(a) सहोदर (b) अग्रज
(c) अनुज (d) साथी

24. नीचे दिए गए शब्द समूह के लिए सही शब्द का चयन कीजिए।
जो किसी धर्म या व्यक्ति में आस्था न रखे
(a) निशान्त (b) धर्मनिरपेक्ष
(c) धर्मभीरू (d) नास्तिक

25. नीचे दिए गए शब्द समूह के लिए सही शब्द चुनिए।
वह वस्तु जो छूने लायक न हो
(a) त्याज्य (b) अखाद्य
(c) अदृश्य (d) अस्पृश्य

26. नीचे दिए शब्दों में से शुद्ध शब्द का चयन कीजिए।
(a) दुरव्यवहार (b) दुव्यर्वहार
(c) दुर्व्यवहार (d) दुव्यवहार

27. नीचे दिए शब्दों में से शुद्ध शब्द का चयन कीजिए।
(a) प्रायाश्चित (b) प्रायश्चित
(c) प्रायाश्चित (d) प्रायश्चित

28. नीचे दिए शब्दों में से अशुद्ध शब्द को चुनिए।
(a) दुष्प्रचार (b) दुष्कर्म
(c) दुगुर्ण (d) दुर्विचार

29. नीचे दिए शब्दों में से अशुद्ध शब्द को चुनिए।
(a) अव्यक्त (b) अन्यासक्त
(c) विरक्त (d) परित्यक्त

30. वर्तनी की दृष्टि से सही शब्द का चयन कीजिए।
(a) विशेस (b) विसेश
(c) विषेश (d) विशेष

31. वर्तनी की दृष्टि से सही शब्द का चयन कीजिए।
(a) आकर्षण (b) आकर्षण
(c) आर्कषण (d) आर्कशण

32. 'सद्गुरु' का सन्धि विच्छेद है
(a) सत् + गुरु (b) सत + गुरु
(c) सद् + गुरु (d) सद + गुरु

33. 'पराङ्गमुख' का विपरीतार्थक शब्द है
(a) सम्मुख (b) प्रतिमुख
(c) उन्मुख (d) इनमें से कोई नहीं

34. 'लम्बोदर' कौन-सा समास है?
(a) तत्पुरुष (b) बहुव्रीहि
(c) कर्मधारय (d) अव्ययी भाव

35. 'अनजान' में प्रयुक्त उपसर्ग है
(a) अ (b) अन
(c) अन (d) अनज

36. 'यामिनी' का पर्यायवाची शब्द है
(a) रोशनी (b) बिजली
(c) दामिनी (d) निशा

37. 'गजोड़ी' में प्रयुक्त प्रत्यय है
(a) डी
(b) ऐडी
(c) एडी
(d) जेडी

38. 'वक्र' का विपरीतार्थक शब्द है
(a) निर्यक (b) चतुर्भुज
(c) टेढ़ा (d) सरल

39. 'गाठ बाँधना' मुहावरा का अर्थ है
(a) गाढ़ी मित्रता होना
(b) अच्छी तरह याद होना
(c) कस कर बाँधना
(d) आपस में बाँधना

40. 'संगम' में प्रयुक्त उपसर्ग है
(a) सं (b) सम
(c) संग (d) सम्

41. 'युधिष्ठिर' कौन-सा समास है?
(a) बहुव्रीहि (b) तत्पुरुष
(c) कर्मधारय (d) अव्ययी भाव

42. इनमें से कौन व्यंजन सन्धि का उदाहरण है?
(a) निष्फल (b) पराजकर
(c) किंचित (d) इनमें से कोई नहीं

43. सूक्ति का सही सन्धि विच्छेद होगा
(a) स + उक्ति (b) सु + उक्ति
(c) सम + उक्ति (d) स + उक्ति

44. स्वयं सेवकों ने व्रत रखा।
(a) आजीवन (b) आमरण
(c) आजन्म (d) आमान

45. 'बदस्तूर' उपसर्ग है
(a) वद (b) बद्
(c) बदस (d) ब

46. नागरी लिपि कौन-सी भाषा की लिपि नहीं है?
(a) मराठी (b) हिन्दी
(c) संस्कृत (d) गुजराती

47. 'अन्न-जल उठना' का अर्थ है
(a) आर्थिक स्थिति कमजोर होना
(b) किसी से सम्बन्ध विच्छेद होना
(c) किसी चीज का अन्त होना
(d) मृत्यु को प्राप्त होना

48. यह एक सह कथानक है।
(a) पुराणिक
(b) पौराणिक
(c) पौराणक
(d) पुराणकीय

49. जिसकी माप न की जा सके
(a) प्रमेय
(b) परिमेय
(c) अपरिमेय
(d) निर्मेय

50. अन्धा होना का अर्थ है
(a) प्रेम करना
(b) मनमाना कार्य करना
(c) पूरी तरह विवेक खो देना
(d) चाहे जिधर चल देना

Answers

Physics

1. (b)	2. (a)	3. (a)	4. (d)	5. (b)	6. (a)	7. (a)	8. (a)	9. (a)	10. (b)
11. (c)	12. (a)	13. (b)	14. (d)	15. (d)	16. (a)	17. (c)	18. (a)	19. (a)	20. (a)
21. (a)	22. (b)	23. (a)	24. (a)	25. (c)	26. (d)	27. (b)	28. (c)	29. (a)	30. (b)
31. (b)	32. (d)	33. (b)	34. (a)	35. (d)	36. (b)	37. (a)	38. (a)	39. (c)	40. (d)
41. (a)	42. (c)	43. (a)	44. (a)	45. (b)	46. (c)	47. (d)	48. (a)	49. (c)	50. (c)

Chemistry

1. (c)	2. (b)	3. (a)	4. (a)	5. (a)	6. (a)	7. (b)	8. (d)	9. (b)	10. (a)
11. (a)	12. (b)	13. (a)	14. (c)	15. (c)	16. (b)	17. (d)	18. (d)	19. (a)	20. (a)
21. (a)	22. (a)	23. (b)	24. (c)	25. (c)	26. (a)	27. (a)	28. (b)	29. (b)	30. (b)
31. (b)	32. (a)	33. (b)	34. (a)	35. (b)	36. (c)	37. (c)	38. (b)	39. (b)	40. (a)
41. (b)	42. (b)	43. (c)	44. (c)	45. (d)	46. (b)	47. (a)	48. (c)	49. (a)	50. (a)

Zoology

1. (c)	2. (a)	3. (b)	4. (a)	5. (c)	6. (a)	7. (a)	8. (a)	9. (a)	10. (c)
11. (d)	12. (c)	13. (b)	14. (d)	15. (c)	16. (c)	17. (d)	18. (d)	19. (a)	20. (b)
21. (b)	22. (c)	23. (a)	24. (a)	25. (b)	26. (d)	27. (b)	28. (d)	29. (d)	30. (a)
31. (b)	32. (a)	33. (c)	34. (c)	35. (b)	36. (c)	37. (d)	38. (c)	39. (a)	40. (d)
41. (b)	42. (b)	43. (b)	44. (b)	45. (b)	46. (d)	47. (a)	48. (a)	49. (d)	50. (a)

Botany

1. (b)	2. (d)	3. (a)	4. (c)	5. (d)	6. (b)	7. (a)	8. (c)	9. (b)	10. (a)
11. (c)	12. (a)	13. (a)	14. (a)	15. (d)	16. (a)	17. (d)	18. (c)	19. (a)	20. (a)
21. (b)	22. (d)	23. (d)	24. (b)	25. (c)	26. (c)	27. (d)	28. (a)	29. (b)	30. (d)
31. (c)	32. (d)	33. (a)	34. (c)	35. (a)	36. (d)	37. (a)	38. (a)	39. (b)	40. (b)
41. (c)	42. (d)	43. (a)	44. (a)	45. (a)	46. (b)	47. (b)	48. (c)	49. (a)	50. (a)

हिन्दी

1. (b)	2. (d)	3. (d)	4. (c)	5. (a)	6. (a)	7. (a)	8. (c)	9. (a)	10. (a)
11. (b)	12. (c)	13. (b)	14. (a)	15. (a)	16. (d)	17. (b)	18. (b)	19. (c)	20. (d)
21. (c)	22. (b)	23. (a)	24. (d)	25. (d)	26. (c)	27. (d)	28. (a)	29. (a)	30. (a)
31. (b)	32. (a)	33. (c)	34. (b)	35. (a)	36. (d)	37. (c)	38. (a)	39. (c)	40. (d)
41. (b)	42. (a)	43. (b)	44. (b)	45. (d)	46. (a)	47. (a)	48. (b)	49. (c)	50. (c)

Hints & Solutions

Physics

1. $\pi = T\dfrac{dE}{dT} = TS$

2. We have, $R = \dfrac{V}{I} = \dfrac{20}{2.5} = 8\,\Omega$, $\dfrac{\Delta R}{R} = \dfrac{\Delta V}{V} + \dfrac{\Delta I}{I}$

$$= \frac{1}{20} + \frac{0.50}{2.5} = \frac{1}{4}$$

$$\Delta R = \frac{R}{4} = \frac{8}{4} = 2\,\Omega$$

$$R = (8 \pm 2)\Omega$$

3. Intensity $= \dfrac{\text{Energy}}{\text{Area} \times t}$

4. Speed of light $c = 3 \times 10^8$ m/s

Distance $= 3.5 \times 10^8$ m

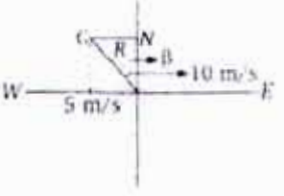
$$\text{Time} = \frac{\text{Distance}}{c} = \frac{3.5 \times 10^8}{3 \times 10^8}$$

$= 1.16$ s (approx.)

5. By $R = \delta\dfrac{l}{A}$ and $R = \dfrac{V}{i} = \dfrac{W}{Qi}$

6. $\tan\beta = \dfrac{AC}{OA} = \dfrac{5}{10} = \dfrac{1}{2}$

$\Rightarrow \beta = \tan^{-1} 1/2$ west of north



7. The excess pressure inside the bubble

$$p = \frac{4T}{r}, \text{Then } p_1 = \frac{4T}{r_1} \quad \ldots(i)$$

$$p_2 = \frac{4T}{r_2} \quad \ldots(ii)$$

From Eqs. (i) and (ii),

$$\frac{p_1}{p_2} = \frac{4\pi / r_1}{4\pi / r_2} = \frac{r_2}{r_1} = \frac{1}{2}$$

8. Maximum height and time of height depends upon the vertical component of initial velocity.

$$H_1 = H_2 \Rightarrow V_{y_1} > V_{y_2}$$

Range $R_2 > R_1$

So, $u_2 > u_1$

9. Given, $R = 4$ m

$$v = \sqrt{gR} = \sqrt{9.8 \times 4}$$

Now, time period $= \dfrac{2\pi R}{v} = \dfrac{2 \times 3.14 \times 4}{\sqrt{9.8 \times 4}}$

$= 4$ s

10. In the stable equilibrium position, a body has minimum potential energy.

11. The capacitance of spherical conductor is given by $C = 4\pi\varepsilon_0 r$

Here, $r = 1$m, $4\pi\varepsilon_0 = \dfrac{1}{9 \times 10^9}$

$$C = \frac{1}{4 \times 10^9} \times 1$$

$$= 2.5 \times 10^{-10}\ \text{F}$$

12. As according to Bernoulli's principle, an ideal fluid has streamline flow in a tube of non-uniform cross-section , then the sum of pressure energy, kinetic energy and potential energy at any cross-section per unit volume is constant.

13. V_B = Potential at B due to A + Potential at B due to B

$$V_B = \frac{-Gm_2}{R} - \frac{Gm_1}{\sqrt{2}R}$$

$$V_A = \frac{-Gm}{R} - \frac{-mGm_2}{\sqrt{2}}$$

$$W_{A \to B} = m(V_B - V_A) = \frac{Gm(m_1 - m_2)}{\sqrt{2}R}(\sqrt{2} - 1)$$

14. It will act like three capacitors which are connected in parallel order, so equivalent capacitance

$$C = C_1 + C_2 + C_3 = 3 + 3 + 3 = 9\,\mu\text{F}$$

15. $C_{13} = C_1 + C_3 = 9 + 9 = 18\,\mu$F

$$C_{2\text{-}13} = \frac{C_2 \cdot C_{13}}{C_2 + C_{13}} = \frac{9 \times 18}{9 + 18} = 6\,\mu\text{F}$$

$$C_{eq} = C_{2\text{-}13} + C_4 = 6 + 9 = 15\,\mu\text{F}$$

16. Total resistance $= 6 + 9 + 5 = 20\,\Omega$

Effective potential difference $= 20 \times 2 = 40$ V

The emf of two batteries $12 - 4 = 8$ V is opposing the potential difference across A B.

So, potential difference across AB
$= 40 + 8 = 48\,V$

17. We have $R = \frac{nr}{m}$, so grouping of cells depends upon the relative values of internal and external resistance.

18. As the current in heater filament increases, it gets more heated. Hence, its temperature increases and resistance also increases, due to which the current will decrease.

19. Red, because it contains maximum wavelength and minimum refractive index and refractive index is inversely proportional to wavelength.

20. $\frac{1}{f} = \left[\frac{\mu_1}{\mu_2} - 1\right]\left[\frac{1}{R_1} - \frac{1}{R_2}\right]$.

Given $R_1 = 0.30\,m$,
$R_2 = -0.30\,m$, $\mu_1 = 3/2$, $\mu_2 = 4/3$
By putting values,
$f = 1.20\,m$

21. According to Kepler's third law.
$T^2 \propto r^3 \Rightarrow T \propto r^{3/2}$
We have $\omega = \frac{2\pi}{T}$
$\omega \propto r^{-3/2}$
Now, $L = mr^2\omega \Rightarrow L \propto r^2 \propto r^{-3/2}$
$\therefore \quad L \propto r^{1/2}$

22. Then thermocouples are joined in series, the thermo emf's set-up in each thermocouple will help to increase the current in the external load. Therefore, the total thermo emf will be increased.

23. The heat absorbed by a substance is directly proportional to its specific heat.Therefore, a coolant having high specific heat will absorb a large amount of heat from the engine. So, water is used as a coolant to cool the car engines in radiators.

24. Given equation is
$y = 5\{\sin 3\pi t + \sqrt{3}\cos 3\pi t\}$
or $y = 5 \times 2\left[\sin 3\pi t \times \frac{1}{2} + \frac{\sqrt{3}}{2}\cos 3\pi t\right]$
or $y = 10\left[\sin 3\pi t \cos\frac{\pi}{3} + \cos 3\pi t \sin\frac{\pi}{3}\right]$
or $y = 10\sin\left(3\pi t + \frac{\pi}{3}\right)$

25. $a_1 = 10$, $a_2 = \sqrt{25 + 75} = 10$
$a_1 : a_2 = 1 : 1$

26. They travel with equal speed which is equal to the speed of light i.e., 3×10^8 m/s.

27. The order of wavelength of X-rays is 1 Å.

28. $I = \frac{2}{5}MR^2 = \frac{2}{5}\left[\frac{4}{3}\pi R^3\rho\right]R^2 = \frac{8}{15}\pi R^5\rho$
$\pi = \frac{22}{7}$
$I = \frac{176}{105}R^5\delta$

29. The radius of gyration does not depend on the total mass of a body but depends upon the shape and size of body distribution of mass within the body and choice of rotation of axis.

30. $T = \frac{2\pi r}{v_0} = \frac{2\pi r}{\sqrt{\frac{Gm}{r}}}$
$\Rightarrow \quad T \propto r^{3/2}$
From the above relation, T increases as h increases.

31. $T = 2\pi\sqrt{\frac{l}{g}}$
$\log T = \log 2\pi + \frac{1}{2}\log l - \frac{1}{2}\log g$
Differentiating, $\frac{dT}{T} = 0 + \frac{dl}{2l} - \frac{1}{2}\frac{dg}{g}$
$\because \quad l = \text{Constant}$
$\therefore \quad dl = 0$
$100 \times \frac{dT}{T} = \frac{-1}{2}\frac{dg}{g} \times 100$
$= \frac{-1}{2} \times \frac{(-2) \times 100}{g \times 100} = +1\%$ increase

32. A torsional vibration of this type restoring torque is directly proportional to angular displacement $\tau = -K\theta$, where K is constant. Hence, it is angular harmonic oscillation.

33. Intensity of spherical wave $(I) \propto \frac{1}{r^2}$

Also, $I \propto a^2$

$\therefore$ $a \propto \frac{1}{r}$

The spherical progressive wave can be represent as $y = \frac{1}{r}\sin(\omega t - kx)$

Among the given options, $y = \frac{a}{r}\sin(\omega t - kx)$ is correct.

34. When the shift in star light is towards red end wavelength increases and the apparent frequency is less than the actual. The star must be receding away from the earth.

35. Temperature, and medium change affect the velocity of sound. Change in wavelength does not further there is no effect of change in pressure on velocity of sound.

36. A solid is floating in liquid, so weight of solid body = weight of liquid displaced by immersed part of the body

$VDg = vdg \Rightarrow \frac{v}{V} = \frac{D}{d}$

37. When a ball is given anticlockwise rotation along with linear motion towards RHS, then it will have maximum height.

38. Newton's cooling law is given as

$$\frac{\theta_1 - \theta_2}{t} = k\left[\frac{\theta_1 + \theta_2}{2} - \theta_0\right]$$

Given, $\theta_0 = 25°$ C

$\theta_1 = 50°$ C and $\theta_2 = 60°$ C

By putting values, $k = \frac{1}{3}$

Again, $\theta_2 = \theta$, $\theta_1 = 50°$ C, $\theta_0 = 25°$ C

$\therefore$ $\theta = 42.8°$ C

39. $C_s = \sqrt{\frac{\gamma p}{d}} = \sqrt{\frac{3p}{d}}$.

So, $C_s > C$

$C_s = C\left(\frac{\gamma}{3}\right)^{1/2}$

40. $dU = dQ - dW \Rightarrow dW = dQ - dU$

For, ideal gas, $dU = 0$

$\therefore dW = dQ = R[T_2 - T_1]$

$= 8.31 \times 100 = 8.31 \times 10^2$ J

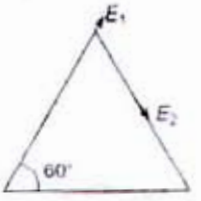
41. $e = 1 - \frac{T_2}{T_1}$

$T_2 \Rightarrow$ sink temperatuse and $T_1 \rightarrow$ source temperature

$0.6 = 1 - \frac{T_2}{400} \Rightarrow \frac{T_2}{400} = 0.4 \Rightarrow T_2 = 160$ K

$T_2 = 160$ K $= -113°$ C

42.



Here, $E_1 = E_2 = \frac{1}{4\pi\varepsilon_0}\cdot\frac{q}{a^2}$

$E = \sqrt{E_1^2 + E_2^2 + 2E_1E_2\cos\theta}$

Given $\theta = 60°$

By calculation, $E = \frac{q\sqrt{3}}{4\pi\varepsilon_0 a^2}$

43. Inside the sphere, $E \propto r$

Outside the sphere, $E \propto \frac{1}{r^2}$

44. $P = Vi \Rightarrow i = \frac{P}{V}$

$i = 800$ A

By Faraday's first law,

$m = Zit$

$0 = 0.367 \times 10^{-6} \times 800 \times 60$

$= 17.6 \times 10^{-3}$ kg

45. In series, $P = \frac{P_1P_2}{P_1 + P_2}$

Given $= P_1 = P_2 = 60$

$\therefore \quad P = \frac{60 \times 60}{60 + 60} = 30\ \text{W}$

46. $Zit = m$

$\Rightarrow i = \frac{m}{Zt} = \frac{5 \times 10^{-3}}{3.387 \times 10^{-7} \times 60 \times 60} = 4.1\ \text{A-h}$

47. $i = \frac{e}{T} = \frac{ev}{2\pi r}, A = \pi r^2$

$m = iA = \frac{erv}{2}$

48. The amount of induced charge is given by

$q = \frac{1}{R}\Delta\phi = \frac{1}{100}(60 - 10)$

(where, $\phi = 10\text{Wb}, \phi_2 = 60\text{Wb}, R = 100\,\Omega$)

$\therefore \quad q = \frac{50}{100} = 0.5\ \text{C}$

49. $t_1 = 2\pi\sqrt{\frac{I}{mv}}, t_2 = 2\pi\sqrt{\frac{I}{mH}}$

$V = H\tan\delta \Rightarrow \frac{V}{H} = \tan\delta$

But, $\frac{V}{H} = 1$

$\therefore \quad \tan\delta = 1 \Rightarrow \delta = 45^\circ$

50. At Curie temperature, ferromagnetic material becomes paramagnetic.

Chemistry

1. In SO_3, the number of hybrid orbitals,

$$H = \frac{1}{2}[V + M - C + A]$$

$$= \frac{1}{2}[6 + 0 - 0 + 0] = 3$$

Thus, hybridisation is sp^2.

Since, SO_2 contains one lone pair of electrons, its geometry becomes V shape.

2. $2AgNO_3 \xrightarrow[\Delta]{\text{above } 485\text{K}} AgNO_2 + O_2$

$\xrightarrow{980\text{K}, \Delta} 2Ag \downarrow + 2NO_2 + O_2$

3. $2KBr + Cl_2 \longrightarrow 2KCl + Br_2$

A halogen can oxidise halide ions of higher atomic number. Furthermore, the oxidising ability of halogens in aqueous solution decreases down the group with increase in atomic number.

4. Malachite, $CuCO_3 \cdot Cu(OH)_2$ is an ore of copper.

5. C_2H_2 (H—C≡C—H) is linear in shape.

6. Ammonia molecule is sp^3 hybridised. It is trigonal pyramidal with the nitrogen atom at the apex. Due to the presence of one lone pair of electrons its shape becomes trigonal pyramidal from tetrahedral.

7. Iron is rendered passive due to the formation of layer of ferro-ferric oxide (FeO Fe_2O_3 or Fe_3O_4).

8. Acidic strength of oxides decreases down the group. Thus, the order of acidic strength of group-15 elements is

$N_2O_5 > As_2O_5 > Sb_2O_5 > Bi_2O_5$

9. On moving along a period from left to right in the Periodic Table, electronegativity increases (due to decrease in size). While on moving downward in a group, electronegativity decreases. Thus, the correct order of electronegativity is

$$\underset{(1.8)}{Si} < \underset{(2.1)}{P} < \underset{(2.5)}{C} < \underset{(3.0)}{N}$$

10. The correct option is

$4NH_3(g) + \underset{\text{from air}}{5O_2(g)} \xrightarrow[500\,\text{K}, 9\text{bar}]{\text{Pt / Rh gauge catalyst}} 4NO + 6H_2O$

11. Basic character of trihalides follows following derceasing order

$NI_3 > NBr_3 > NCl_3 > NF_3$

Hence, NF_3 is least basic.

Despite the presence of a lone pair of electrons on nitrogen, NF_3 does not act as a Lewis base. There is no known compound in which it donates a pair of electrons to other reagents.

12. $2H_2 + O_2 \longrightarrow 2H_2O$

10 g 64 g

5 mol 2 mol

4 mol H_2 + 2 mol O_2 ⟶ 4 mol H_2O

(1 mol remaining)

∴ Here, O_2 is limiting reagent.

13. Number of electrons in

$CO = 6 + 8 = 14$

$CN^- = 6 + 7 + 1 = 14$

$N_2 = 7 + 7 = 14$

$N_2^+ = 7 + 7 - 1 = 13$

$NO^+ = 7 + 8 - 1 = 14$

CO is isoelectronic with CN^- because both species have same number of electrons.

14. Let the oxidation number of Cr in $Cr_2O_7^{2-}$ is x.

$2x + (7 \times -2) = -2$

$2x = -2 + 14$ or $x = 12/2 = +6$

15. Tritium is a radioactive isotope of hydrogen.

16. $_5B = 2, 3$

$_{17}Cl = 2, 8, 7$

In BCl_3, B has 6 electrons.

Therefore, it has incomplete octet.

17. $CaSO_4 \cdot 2H_2O$ — Gypsum;

$CaSO_4 \cdot \frac{1}{2} H_2O$ – plaster of Paris

18. $Ba(OH)_2$ is the most basic hydroxide because basic strength of hydroxide increases on moving down the group.

19. Gypsum is added to decrease the rate of setting of cement and it converts fast setting tricalcium aluminate to calcium sulphoaluminate which sets slowly.

20. Colligative properties depend only on the number of solute particles in the solution. For different solutes of same molar concentration, the colligative properties (osmotic pressure) have greater value for the solution which gives more number of particles on ionisation.

$CaCl_2(aq) \rightleftharpoons Ca^{2+}(aq) + 2Cl^-(aq) = 3$ ions

$NaCl(aq) \rightleftharpoons Na^+ + Cl^- = 2$ ions

$C_6H_{12}O_6(aq) \longrightarrow$ No ions

Hence, the order of osmotic pressure of equimolar solutions of $CaCl_2$, NaCl and glucose will be

$CaCl_2 >$ NaCl > glucose ($C_6H_{12}O_6$)

21. Oxygen atom of each H_2O molecule is covalently linked with two H-atoms of its own molecule and with another H-atom of adjacent H_2O molecules by H-bonding.

22. Goldschmidt in 1905 discovered a method for the reduction of haematite (Fe_2O_3) with aluminium metal (Aluminothermic process). In this, Fe_2O_3 and Al are taken in 3 : 1 ratio and this mixture, known as thermite, is ignited to initiate the reaction, when Fe_2O_3 is reduced to molten Fe.

$2Al + Fe_2O_3 \longrightarrow \underset{\text{molten}}{Al_2O_3} + 2Fe + 3230$ kJ

23. H_3BO_3 is a weak acid and ionises mainly as monobasic acid. It does not liberate H^+ ion but it accepts OH^- i.e., behaves as Lewis acid.

$H_3BO_3 + H_2O \longrightarrow B(OH)_4^- + H^+$

24. A catalyst does not alter the equilibrium constant. It helps in easy attainment of equilibrium.

25. $\frac{r_A}{r_B} = \sqrt{\frac{M_B}{M_A}}$ or $\frac{V_A}{t_A} \times \frac{t_B}{V_B} = \sqrt{\frac{M_B}{M_A}}$

$\therefore V_A = V_B$ (given in the question)

$\frac{10}{20} = \sqrt{\frac{M_B}{49}}$

$\frac{1}{4} = \frac{M_B}{49}$

$M_B = 49/4 = 12.25$ u

26. Lower the value of heat of neutralisation, weaker is the acid and *vice-versa*. Hence, *B* is the weakest and *A* is the strongest acid in the given options.

27. $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

$(1 - x)$ x x

Total number of moles at equilibrium

$= (1 - x) + x + x = 1 + x$

$P_{PCl_5} = \left(\frac{x}{1+x}\right) \times P$

Total number of moles at equilibrium
$= (1 - x) + x + x = 1 + x$

$$P_{PCl_5} = \left(\frac{x}{1+x}\right) \times p$$

28. $aA + bB \rightleftharpoons cC + dD$

Equilibrium constant $K = \frac{[C]^c [D]^d}{[A]^a [B]^b}$

$naA + nbB \rightleftharpoons ncC + ndD$

Equilibrium constant, $K' = \frac{[C]^{nc} [D]^{nd}}{[A]^{na} [B]^{nb}}$

$$= \left(\frac{[C]^c [D]^d}{[A]^a [B]^b}\right)^n = K^n$$

29. Sucrose does not reduce Benedict's reagent because it is a non-reducing sugar.

30. Nitro group goes always to *meta* position, in aromatic compounds, irrespective to the substituents.

31. $CH_3CH_2—O—N=O$ is a nitrite derivative, hence it is not a nitro derivative.

32. $C_4H_{10}O \xrightarrow{HI}$ only one type of halide. Therefore, $C_4H_{10}O$ may be a symmetrical ether *i.e.*, ethoxyethane.

$C_2H_5OC_2H_5 + 2HI \rightarrow 2C_2H_5I + H_2O$

ethoxyethane.

33. Formic acid has $-\overset{O}{\overset{\|}{C}}-H$ (aldehyde) group. It reduces Tollen's reagent to silver mirror like other aldehydes on the other hand, acetic acid cannot reduce Tollen's reagent.

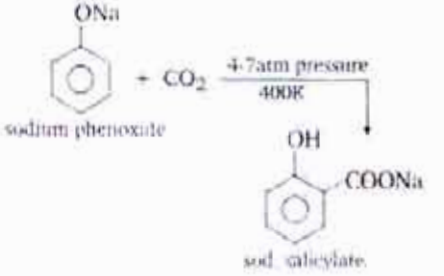
34. Cetyltrimethyl ammonium chloride is used to prepare cosmetics because it has germicidal property.

35. Terylene is a polyester polymer because it is formed by the monomer units terephthalic acid (an acid) and ethylene glycol (an alcohol).

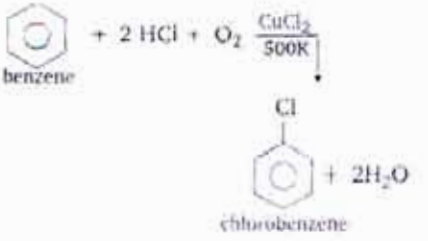
36. Ether on reacting with P_2S_5 form thioether.

$5R—O—R + P_2S_5 \longrightarrow 5R—S—R + P_2O_5$

37.



38. Raschig process is the commercial method for the preparation of chlorobenzene from benzene.



39. Electron withdrawing groups like $-NO_2$, $-X$ etc., decrease the stability of carbonium ion. So, the stability order is

$$Cl_3\overset{+}{C} < Cl_2\overset{+}{C}H < ClC\overset{+}{H}_2 < \overset{+}{C}H_3$$

40. $CH_2=CH-CH_2-\overset{O}{\overset{\|}{C}}-OH$

but-3-enoic acid

41. Moles of carbohydrate = 0.833

weight of hydrogen = 10 g

$\because$ 0.833 moles of carbohydrate has hydrogen = 10 g

1 mole of carbohydrate has hydrogen $= \frac{10 \times 1}{0.833} = 12g$

Given, empirical formula of carbohydrate $= CH_2O$

$\because$ CH_2O contains hydrogen = 2g hydrogen per mole

$\therefore$ Molecular formula should contain hydrogen $= \frac{12 \times 2}{2} = 12$

Molecular formula $= C_6H_{12}O_6$

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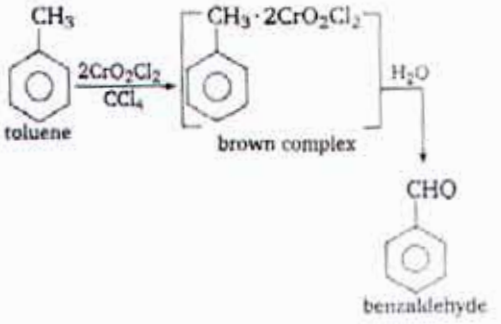
42. This reaction involves the partial oxidation of toluene with chromyl chloride (CrO_2Cl_2) solution in CCl_4 or CS_2. The product formed is benzaldehyde.



43. Oleic acid is 9-octadecanoic acid.

$CH_3(CH_2)_7CH = CH(CH_2)_7COOH$

44. $CH \equiv CH \xrightarrow{HOCl} CHOH = CHCl \xrightarrow{HOCl} CH(OH)_2 - CHCl_2 \longrightarrow CHO - CHCl_2$

45. Benzamide undergoes dehydration on reaction with $POCl_3$ and phenyl nitrile is formed.

$$\underset{\text{benzamide}}{C_6H_5CONH_2} \xrightarrow[\text{dehydration}]{POCl_3} \underset{\text{phenylnitrile}}{C_6H_5CN}$$

46. The hydrolysis reaction of conjugate base of acid is

$$A^-(aq) + H_2O \longrightarrow HO^- + HA$$

$$K_h = \frac{K_w}{K_a} = \frac{10^{-14}}{10^{-4}} = 10^{-10}$$

Since, degree of hydrolysis is negligible,

$\therefore \quad [OH^-] = \sqrt{K_h C} = 10^{-6}$

$\therefore \quad pOH = \log 10^{-(OH^-)}$

$\therefore \quad pOH = 6$

$pH = 14 - 6 = 8$

47. $\because$ 2 and M$[H_3O^+]$ ions are obtained from 1 M H_2SO_4

$\therefore$ 1 M$[H_3O^+]$ ions are obtained from 0.5 M H_2SO_4 Molarity,

$$M = \frac{m\,(H_2SO_4) \times 1000}{M(\text{molar mass } H_2SO_4) \times \text{Volume of solution(mL)}}$$

$$0.5 = \frac{m \times 1000}{98 \times 200}$$

$$m = \frac{0.5 \times 98 \times 200}{1000} = 9.8\ g$$

48. $1s^2$ has the highest value of ionisation potential, because the outermost electrons are very close to nucleus.

49. H_2O_2 decomposes on standing and heating. It is an example of auto oxidation-reduction.

$2H_2O_2 \longrightarrow 2H_2O + O_2$

(−1) (−2) (0) (oxidation no. of oxygen)

50. (i) $C + O_2 \longrightarrow CO_2;\ \Delta H = -94.0$ kcal

(ii) $H_2 + \frac{1}{2}O_2 \longrightarrow H_2O;\ \Delta H = -68.4$ kcal] $\times 2$

(iii) $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O;\ \Delta H = -212.4$ kcal

On multiplying Eq. (ii) with 2, add Eq. (i) and subtract Eq. (iii), we get

$C + 2H_2 + 2O_2 \longrightarrow CO_2 + 2H_2O,\ \Delta H = -230.8$ kcal

$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O;\ \Delta H = -212.4$ kcal

$C + 2H_2 \longrightarrow CH_4;\ \Delta H = -18.4$ kcal

Biology

Zoology

1. In direct development, the young ones resemble the adult completely except for size, colour and reproductive maturity. In indirect development, the larval stages are present. Glochidium larva is the characteristic feature of Mollusca. Glochidium larva is found in members of class- Pelecypoda (*Unio*, *Pinctada*) but absent in Cephalopoda (*Sepia*).

2. Nematoblasts (Cnidoblasts) are stinging cells, which have given the name Cnidaria to these coelenterates. They occur only in epithelium (Two germ layer ectoderm and endoderm are

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present here). They are sensitive cells, which can explode to cause injury to the prey. They also take part in attachment.

3.

Teeth	Characteristic
Acrodont	Teeth attached to free surface of jaw bones, *e.g.*, frog, shark.
Thecodont	Teeth embedded in the socket of jaw bones, *e.g.*, crocodile mammals.
Polyphyodont	Teeth replaced many times in life, *e.g.*, fish, frog.
Monophyodonts	Teeth formed once in life time, *e.g.*, *Platypus*, whales.

4. Each arm consists of one humerus, one radius, one ulna, 8 carple bones, 5 metacarpal bones and 5 digits (14 phalanges).

Pelvic girdle is formed of two innominate bones. Each innominate bone consists of elium, ischium and pubis.

The bones which make the legs are femur, tibia, fibula, patella, tarsal bones, metatarsal bones and 5 digits.

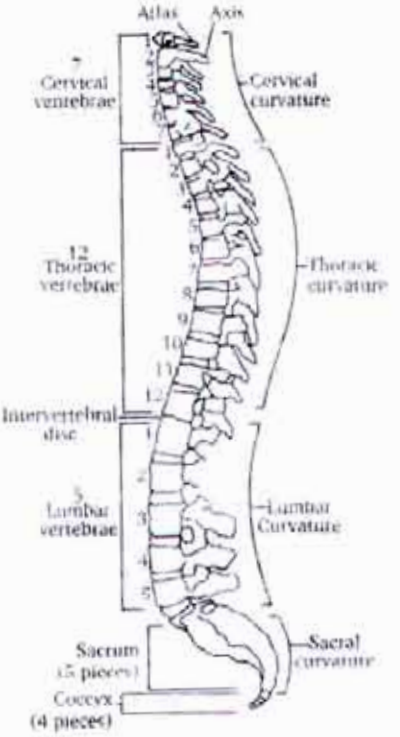
5. The dissolved CO_2 in blood reacts with water to form carbonic acid. This reaction is very slow in blood plasma but occurs very rapidly in RBCs because a zinc containing enzyme carbonic anhydrase found in RBCs which accelerate reaction rate about 5000 times.

Leucocytes or WBCs are colourless, rounded, nucleated cells and act as soldiers.

Lymphocytes and monocytes are agranulocytes WBCs. Lymphocytes are non-phagocytic and secrete antibodies while monocytes are phagocytic.

6. The mid brain (consisting of corpora quadrigemina and cerebral peduncle), pons varolii and and medulla oblongata are collectively called brain stem, connecting the fore brain and spinal cord. Cerebrum is a part of fore brain and is largest and most complex of all parts of human brain.

7. The vertebral column is made up of 33 vertebrae, which are categorised into five groups–cervical, thoracic, lumber, sacrum and coccyx.



8. When a stimulus of adequate strength (threshold stimulus) is applied to a polarized membrane the permeability of the membrane to Na^+ is greatly increased. It is due to the fact that the Na^+ channels open and K^+ channels remain closed. As a result Na^+ inflow by diffusion. Since, more Na^+ entered than leaving, the electrical potential of the membrane changes from -70 mv to zero. At this potential the membrane is called depolarized with the increase in Na^+ inside the nerve fibre the membrane becomes less permeable to Na^+ and more permeable to K^+. Na^+ influx stops and K^+ outflow begins until the original resting state of ionic concentration is achieved. This is called replorization of membrane.

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9. Blood corpuscles are of three types, i.e. RBCs, WBCs and thrombocyte.

Red blood cells are most abundant and responsible for oxygen and CO_2 transport.

White blood corpuscles are of two types, i.e. granulocyte (eosinophil, basophils and neutrophils) and agranulocytes (i.e, lymphocytes and monocytes). Lymphocytes produces antibodies, eosinophils are non-phagocytic and basophils release, heparin, histamine and seroronin.

10. WBCs are of two type, i.e. agranulocyte and granulocytes

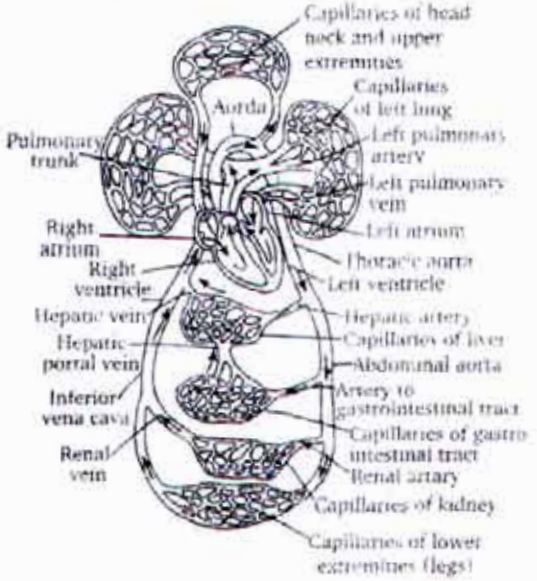
Agranulocytes

(i) Lymphocyte — 20 - 40% of WBCs
(ii) Monocyte — 20 - 10% of WBCs

Granulocytes

(i) Eosinophils — 1 - 6%
(ii) Basophils — 0 - 1%
(iii) Neutrophils — 40 - 75%

11. The flow of deoxygenated blood from right ventrical to lungs and return of oxygenated blood from lungs to left atrium is called pulmonary circulation. Pulmonary arteries supply deoxygenated blood to lungs while two pulmonary veins from each lung transport oxygenated blood to left atrium.



12. The pressure exerted by the flow of blood on the elastic walls of the arteries is called blood pressure. In normal young person the systolic pressure is 120 mm Hg and diastolic pressure is 80 mm Hg. The blood pressure is measured by sphygmomanometer.

13. During pregnancy the placent provides for the exchange of nutrients and wastes between the mother and developing foetus. It secretes some hormone like oestrogen, progesterone, human chorionic gonadotropin (HCG) and relaxin.

Testosterone is secreted by interstitial cells or Leydig's cells of testes.

Glucagen is secreted from alpha cell of pancreas. It stimulates the liver to convert stored glycogen to glucose.

It is known that pineal gland secretes the hormone melatonin. Its concentration in blood appears to flow a diurnal cycle.

14. A typical mammalian sperm consists of head, neck, middle piece and tail.

The head forms the acrosome, which contains hydrolytic enzymes used to contact and penetrate the egg at the time of fertilization.

The neck contains proximal centriole towards the nucleus.

The middle piece contains the mitochondria coiled round the axial filament called mitochondrial spiral.

The sperm swims about by its tail in a fluid medium.

15. Cleavage is a series of rapid mitotic divisions of the zygote which convert the single celled zygote to multicellular blastula. Based on amount and pattern of distribution of yolk in the zygote cleavage is of two types

(i) **Holoblastic** Divide the zygote and blastomere completely into daughter cells. It may be equal (starfish) or unequal (frog).

(ii) **Meroblatic** The division are confined to animal pole only. It may be discoidal (reptiles, birds and egg lying mammals) or superficial (insects).

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16. Contraception is the prevention of fusion of male and female gamete. In vasectomy the vas deferens of male cuted while in tubectomy both oviducts of female are cuted.

Diaphragm is a flexible rubber dome which fixes over the cervix and prevents entry of sperm to uterus.

17.

Excretory organs	Example
Malpighian tubules	Arthropods
Nephridia	Annelids
Flame cells	Platyhelminthes
Coxal gland	Spiders

18. The sacroplasm of skeletal muscles contain myofibrils made up of bundle of parallel protein microfilaments called myofilaments. There are two kind of myofilaments.

(i) **Thick myofilament** Constitute mainly of myosin protein, which contributes 55% of muscle protein by weight.

(ii) **Thin myofilaments** It is composed of actin, tropomysin and troponin.

19. Cretinism is caused due to hypothyroidism (low secretion of thyroxin). It is characterised by retarded mental and physical development. Grave's disease and Plummer's disease are due to over secretion of thyroxin hormone. The principal feature of Plummer's disease is the presence of glandular tissue in the form of limbs.

20. Muscles constitute about 40-50% of human body. They are broadly classified into three categories.

(i) **Smooth** on **non-striated** They are involuntary and are under control of autonomic nervous system. *e.g.*, muscles found in walls of alimentary canals, blood vessels, respiratory passage, etc.

(ii) **Cardiac muscles** Structurally they resembles straited muscles but function ally with smooth muscle. These are found in heart wall.

(iii) **Skeletal muscle** These are voluntary and attached to skeletal elements. Muscles of hands, legs are of this type.

21. The body of echinoderms bear a number of small microscopic interconnected tube feet on the under surface. They take part in locomotion and respiration.

Mantle is muscular, vascular and glandular fold of dorsal body wall of mollusc.

The eyes in arthropods are generally compound having a number of similar unites called ommatidia. Pedicellaria are pincer-like small structures which often occur in between and around the spines. Their major functions is to clear the debris collected on the body of echinoderm.

22. In *Chondrichthyes* (Cartilagenous fishes) dermal bone is absent but surface denticles termed placoid scale persist. These scales give rough feel to the surface of skin.

On the basis of their appearance several types of scales are recognized among bony fishes. The cosmoid scales reside upon double layer of bone. The ganoid scale is without an under of dentin.

Two types of teleost scales are cycloid and ctenoid.

23. The first experimental support to Opain-Haldane theory of origin of life comes from Urey and Miller's experiment. Miller created an atmosphare containing H_2, NH_3, CH_4 and water vapours in one large flask and allowed condensed liquid to accumulate in another small flask. The ratio of methane, ammonia and hydrogen was 2:1:2. Energy was supplied by heating and electric spark. After continuous heating, cooling he obtained a turbid red liquid, which contains urea, organic acids, sugars, purine, pyrimidins and amino acids.

24. Von Bear (1792-1867) proposed Bear's law which states that during development general characters appear before specialized characters. Ernst Haeckel proposed biogenetic law which states that 'ontogeny repeats phylogeny.' It means evolutionary history of a species it indicated by the development stages that is passes through.

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25. Adrenalin (epinephrine) is secreted by Chromaffin cells of adrenal medulla. The secretion of adrenalin is directly controlled by the autonomic nervous system, but not under the control of pituitary. Adrenalin is also called 'emergency hormone' because it contributes the fright, fight or flight reactions, which occur in condition of emergency. Increase in emotional disturbance increase the secretion of adrenalin, accelerating the rate of respiration, dilating respiratory passage, increasing blood pressure, heart beat, sugar level and stimulating cellular metabolism.

    Aldosterone, is a mineralocorticoid or salt retaining hormone secreted by adrenal cortex. Its basic function is in conservation of sodium and water and dimination of potassium.

26. Juvenile hormone is produced by corpora allata in insects, it favours the development of juvenile characteristics. During larval life, this hormone predominates and each moult yields another lager juvenile and keeps the larva in immature condition or maintains juvenility.

    Ecdysone is a steroidal, moulting hormone of the prothoracic glands, named ecdysone in insects that triggers metamorphosis.

    Salivary glands are the merocrine or epicrine type of gland. Their secretion diffuses out through the cell surface, causing no damage to the cell. In man, 3 pairs of salivary glands are present and in rabbit, they are 4 pairs. Salivary glands are absent in frog.

27. Ligaments consist of mainly collagen fibres and some elastic fibres. It connects end of a long bone to another.

    Tendon is a very dense, strong fibrous connective tissue made of collagen fibres. Tendon connects a skeletal muscle to a bone.

    Cartilage is a solid but semi-rigid and flexible connective tissue. Cartilage like the fibrous tissue, is a vascular and nutrients must diffuse into it from nearby tissues.

    Muscles are composed of muscle tissue, that contracts to affect a particular movement.

28. Homeothermic are the animals having a nearby uniform or constant body temperature. These animals are known as warm blooded animals, *e.g.*, birds, man.

    Poikilothermic are those, having a variable temperature which fluctuates with that of environment. They are called the cold blooded animals, *e.g.*, amphibians.

29. Vitamin-K is essential for clotting of blood. It is necessary for the synthesis of various blood clotting factors like prothrombin (2nd), proconvertin (7th), stuart power factor (10th) Christmas factor. It is obtained from cabbage, spinach and other green leafy vegetables.

    Vitamin-A is necessary for synthesis of rhodopsin of rod cells and iodopsin of cone cells of the retina of eyes.

    Vitamin-D promotes absorption of calcium and phosphorus by the intestine. It maintains the normal functioning of parathormone.

    Vitamin-B (B_1) serves as a co-enzyme in the conversion of pyruvate into acetyl Co-A and α-ketoglutarate.

30. The heart wall of frog composed of epicardium, myocardium and endocardium. The myocardium is composed of branched and striated yet involuntary cardiac muscles which contracts and relax rhythmically at a fixed rate. The fibres of the self excitatory and conducting muscle of the heart are those of three types-nodal fibres, transitional fibres and Purkinje fibres.

    In frog heart, a number of muscular bridges called columnae carnae projected from the wall of ventricle into its cavity, dividing the peripheral part of the cavity into a number of pockets.

31. Malpighian tubules are the excretory organs of insects.

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Respiratory glands of insects is tracheae, which opens outside by ten pairs of spiracles, present in thoracic (2 pairs) and abdominal (8 pairs) parts.

Endocrine glands of insects consists of corpora allata, corpora cardiace and prothoracic gland which regulate metamorphosis in insect through different hormonal secretion.

Excretory organ of frog is kidney (mesonephric), large urinary bladder, excretion ureotelic.

32. Fossils provide the direct evidences of organic evolution Fossils may be entire organisms buried in sediment or snow, small part of ancient organisms or impression of extinct organisms, ancient leaf or stem.

Comparative embryology (study of embryo) provides evidence of organic evolution which is based on basic laws or principles of embryonic development (the biogenetic law or recapitulation theory).

Vestigial organs are degenerate, non-functional and rudimentary organs correspond to fully developed and functional organs of related organisms. They also afford to provide evidences for organic evolution.

But, among them most evident and direct proof of evolution is provided by fossils.

33. In Mollusca, each eye is located upon a stumpy peduncle called ommatophore.

In Mollusca, a loose skin fold, called mantle dorsally covers most of the body and encloses a large mantle cavity. The mantle cavity contains the rectum, genital duct, a penis in males and a small bipectinate chemoreceptor called osphradium.

In Mollusca, the large oval aperture or mouth of the shell can be tightly closed by a thick plate-like operculum attached to the foot.

34. White ants are found in the tropical and warm temperate countries of the world. White ants are colonial, polymorphic and social insects.

Bed bugs are usually found in crevices of cots and under the mattresses. They are nocturnal. They also come out during day. Sometimes, they show cannibalism. Locusts are found in greatest abundance in place with open grassland and abundant leafy vegetation, where there is plenty of food and place to breed. The migratory locust are particularly cosmopolitan in distribution.

35. Pseudocoelom is false body cavity, derived from embryonic blastocoel, e.g., Aschelminthes (*Ascaris*). In pseudocoelomates, there is a liquid filled space in which body organs float.

Eucoelom or true coelom lines with two layers of mesoderm, e.g., earthworms. It may be schizocoelom or enterocoelom.

Schizocoelom is the true coelom, originated by splitting of mesoderm and its enlargement to form the cavity, e.g., Annelida, Arthropoda, Mollusca.

Haemocoelom is the true coelom, filled with blood. It is found in arthropods, some annelids and molluses, where the circulatory system is open type (with blood sinuses and lacunae).

36. Turbellaria (*L. turbella*– a string) is a class of phylum–Plathyhelminthes. Turbellarians are mostly free living flat worms, mostly aquatic (marine), characterized by presence of cilia, body unsegmented, mouth ventral, suckers absent with tango, chemo and photoreceptors, e.g., *Planaria* (*Dugesia*), *Bipalium*, etc.

Trematoda (*Gr. trema* = hole; eidos = form), is class of phylum—Platyhelminthes. Commonly called 'flukes', ecto or endoparasites, body without cilia, unsegmented with suckers and hooks, e.g., *Fasciola*, *Schistosoma*, etc.

Cestoda (Gr. *kestos girdle eidos*, from), is also one of the class of phylum—Platyheminthes. They are commonly called 'tapeworms' parasites without cilia and sense organs, body segmented (pseudometamerism), digestive system absent, e.g., *Taenia* and *Echinococcus*

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37. A compact, somewhat flattend and whitish mass, called epididymis is closely abutted against the dorsal aspect of each testis. In rabbit head of epididymis present at the head of the testis is called caput epididyms.

Epididymis differentiated into smaller posterior enlarged part called cauda epididymis.

Testes of rabbits are about 15 to 20 mm long and 10 mm thick, oval and pinkish structures. Each in held in its position within its scrotal asac and is supported from posterior scrotal wall by means of a small cord of fibro-muscular mesodermal tissue called gubernaculum.

From the tip of cauda epididymis, the Wolffian duct continues forwards as an uncoiled and some what thicker male genital duct or vas deferens.

38. **In dissolved state** 7% of CO_2 gets dissolved in the blood plasma and is carried in solution to lungs or about 0.3 mL of CO_2 is transported per 100 mL of blood in dissolved state in blood plasma.

In the form of bicarbonate About 70% of CO_2 (about 2.5 mL per 100 mL of blood) received by blood from tissue, enters the RBCs where it reacts with water to form cabonic acid (H_2CO_3).

As carbaminoheamoglobin About 23% of CO_2 is transported in combination with haemoglobin and plasma proteins. CO_2 reacts directly with amine radicals (NH_2) of haemoglobin to form an unstable compound carbamino-heamoglobin (Hb. CO_2)

Sodium bicarbonate acts as buffer of blood.

39. **Kupffer** cells are the phagocytic cells present over the lining of 'sinusoids' (spaces between the hepatic cords) in liver. These cells destroy wam-out white and red blood cells and bacteria.

Samll intestine possess paneth cells and argentaffin cells secreting digestive enzymes. These cells are present on simple tubular pits of intestinal gland known as 'crypts of Lieberkuhn'.

Pancreas possess groups of cells, islets of Langerhans which contain four type of cell

Alpha cells (32-38%), Beta cells (60-70%), Delta and F-cells (8-8%).

40. Contractile vacuole is the clear rounded, pluisating body present in the posterior part of endoplasm of *Amoeba*. It is found only in fresh water forms and is mainly concerned with osmoregulation, *i.e.*, removal of excess of water.

Plasmalemma, a trilaminar and selectively permeable membrane covering the body, functions both in excretion (ammonia) and respiration in *Amoeba*.

Pseudopodia (false feet) are finger-like and blunt-extension of cell body in protozoans. In *Amoeba*, the type of pseudopodium found in lobopodium composed of both ectoplasm and endoplasm. It is temporary locomotory structure which is also meant for feeding *Amoeba*. Locomotion of *Amoeba* is known as **'amoebiod movement'** (Sol-gel theory).

41. Ca^{2+} is essential of muscle contraction, neuro-muscular function and nerve impulse transmission, as an impulse arrives at a synaptic knob, calcium ions (Ca^{2+}) diffuse into the knobs from surrounding tissue fluid. Ca^{2+} trigger a process in which numerous synaptic vesicles fuse with the membrane of the knob and the areas of fusion break down, releasing the contents of vesicles into the fluid of synaptic cleft.

42. Ornithine cycle or urea cycle or Krebs-Henseleit cycle was discovered by Hans Krebs and Kurt Henseleit. It takes place in liver cells. The main component of ornithine cycle are arginine, ornithine and citrulline.

43. Vestigial organs are imperfectly developed,non-functional organs which were fully developed and functional in related and ancestral forms.

Example Nictitating membrane, tail vertebrate, vermiform appendix.

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44. In commensalism, association between members of different species is made in the way that one is benefitted and neither is harmed, *e.g.*, small fish (sucker fish) gets stuck near the bottom of a shark with the help of its hold fast (modified dorsal fin) and is dispersed to distant areas. It also gets protection (due to association with shark) and derive its nutrition also. However, the shark does not get any benefit or harm form the sucker fish.

Antibiosis refers to the complete or partial inhibition of one organism by another through the production of some substance or environmental conditions as a result of metabolic pathways.

In parasitism the parasite organisms derives food and sometimes shelter also, from the host without killing it.

In predation, predatory organism are free living which catch and kill another species for food.

45. **Liver** is endodermal in origin and is the largest gland in human body. It is the busiest and largest chemical factory in the body.

Liver cells secrete bile directly into bile capillaries, which is used in the emulsification and absorption of fats. Besides, it also functions in manufacture of anticoagulant heparin, plasma protein like albumin, fibrinogen and prothormbin and in deamination of proteins.

Thyroid gland (measures 3-7 cm in length and 25gm in weight in adults) a median endocrine gland located below larynx is the largest endocrine gland in the body. Thyroxine (T_4) produced by thyroid gland, function mainly in controlling metabolism, *i.e.*, basal metabolic rate of the body.

Pancreas is a mixed gland (heterocrine gland) with both exocrine and endocrine portions. The average length of pancreas is 12-15 cm and weight is 50-70 gm. Insulin, glucagon, somatostatin are the hormones secreted by different cells of endocrine portion of pancreas.

Thymus gland (at birth weights 10-12 gm, at puberty 20-30 gm and at old age it weights 3-6 gm) is mainly concerned with immunological function but becom inconspicuous after puberty.

46. Rh factor was discovered by **K Landsteiner** and **AS Wiener** (1940) from rabbit immunized with the blood of monkey *Macaca rhesus*. It is found is man and rhesus monkey only.

47. Apiculture is the rearing of bee or bee keeping for the production of honey and wax. Pisciculture (fish culture) is the rearing and breeding of fishes in ponds, artificial water reservoirs.

Sericulture is the rearing of silkworm or mulberry silkworm (*Bombyx mori*) for commercial production of silk. Caterpillar feeds on mulberry leaves, its salivary gland secretes liquid silk.

48. *Schistosoma mansoni* in the common human **blood fluke.** It belongs to class-Trematoda of Platyhelminthes. Blood fluke is digenetic, primary host is man and secondary host is snail.

Sheep is the primary host of *Fasciola hepatica* (sleep liver fluke), causing 'liver rot'. Its secondary host is also the snail.

Mosquito and housefly do not found to be the intermediate host of any animal.

49. **Archaeocytes** are the totipotent cells, which provide great regenerating power to sponges. Sex cells (sperm and ova) arise from undifferentiated archaeocyte.

Thesocytes are the amoebocytes with reserve food granules.

Pinacocytes are the polygonal flat cells present as outer layer of cells, called pinacoderm lining the spongocoel or body cavity in *Leucosolenia*.

Cnidocytes occur in entire epidermis except that of basal disc and are found only in cnidarians. Cnidocytes are spherical or oval cells.

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50. **Medulla oblongata** is a cylindrical conical hinder most part of brain, which has an internal cavity called fourth ventricle. It has
(i) respiratory centre
(ii) cardiac centre
(iii) reflex centre for swallowing, vomiting, peristalsis, secretion and actively of alimentary canal, salivation, coughing, sneezing, etc.
(iv) vasomoter centre.

Botany

1. The cell wall of fungi is made up of chitin, which is a polymer of NAG (N-acetyl Glucosamine).

   In plants the cell wall is made up of cellulose, hemicellulose and pectin.

   In bacteria the cell wall is composed of peptidoglycon–a polymer of N-acetyl glucosamine and N-acetylmuramic acid.

2. Cellulose is a structural polysaccharide formed of long chain of β-glucose units (6000-10,000). They are straight, unbranched and linear. Adjacent glucose molecules are joined by β 1 → 4 linkage.

   Pectin is a mucopolysaccharide found in cell wall. It is made up of galactose, galacturonic acid and arabinose.

   Lignin is a heterogeneous phenyl propane polymer formed by condensation of coumaryl, coniferyl and sinapyl alcohol.

3. Sieve tubes have thin cellulosic walls. They are without nuclei at maturity. These are conducting element of phloem. Companion cell are thin walled, living cells remain associated with sieve tubes. They help in transport of food along the sieve tubes.

   Vessels are formed by dissolution of end walls of row of cells i.e., vessel elements. The wall of vessels are lignified. At maturity nucleus is absent in vessels but conduction of water is main function of tracheids.

4. Parenchyma is made up of isodiametric, thin walled cells having intercellular space. The main function of parenchyma is storage of food.

   In hydrophytes the parenchyma develops air spaces and such parenchyma with air cavities is known as aerenchyma, which helps in floating or buoyancy.

   Sclerenchyma is composed of dead cells having, thick walled lignified cell walls.

5. ATP (Adenosine Triphosphate) as called energy currency of cells. ATP is energy rich compound where energy is present in terminal pyrophosphate bonds.

   $NADPH_2$ is the assinilitory power formed during light reaction of photosynthesis and utilized in dark reaction. AMP is not energy rich as lacks high energy phosphate bonds.

   GTP is also energy rich compound formed in Krebs' cycle during conversion of succinyl CoA to succinic acid.

6. Pteridophytes are first vascular land plants and thus called 'vascular cryptograms' as vascular tissue (xylem and phloem) is present in these plants.

   Bryophytes are first simplest, non-vascular land plants which grow in moist and shady places and called amphibians of plant kingdom.

   Algae are chlorophyllous thallophytes lacking vascular tissue. Angiosperms are covered seeded plants having xylem and phloem.

7. The dominant phase in life cycle of pteridophyte is sporophyte ($2n$) which is generally herbaceous, rarely woody. The plant body is differentiated into roots, stem and leaves.

   The main plant body of bryophytes is gametophytic which is independent. True roots are always absent but unicellular or multicellular rhizoids are found.

   Zygotic phase is small in plants having alternation of generation.

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8. Pollen grains or microspores are male reproductive bodies, which are uninucleate and divide mitotically to form two male gametes.

   Endosperm is a triploid structure formed by fusion of one male gamete and two polar nuclei.

   During development the functional megaspore undergoes three mitotic divisions to form egg apparatus (2 synergids + 1 egg), two in the centre form polar nuclei and three at the chalazal end form antipodal cells.

9. Both chloroplast and mitochondria are membrane bound cell organelle forming a part of endomembrane system. Mitochondria are found in both plant and animal cells but chloroplast is absent in animal cells. Both chloroplast and mitochondria contain small amount of DNA, RNA and ribosomes (70 S type), thus involved in protein synthesis. Mitochondria is site of respiration while chloroplast is site of photosynthesis.

10. Plasmids are extra chromosomal, circular, double stranded DNA molecules found in bacteria and yeast cells. They have genes for fertility, antibiotic resistance and used as vector in genetic engineering.

    DNA found in nucleus formed nucleosome with histone and non-histone proteins which further folded to form chromatin.

    In eukaryotic cell the DNA outside nucleus is present in chloroplast and mitochondria.

11. In mutualism or symbiosis both the organisms in association are benefitted.

    A predator is an organism, which gets its food from the host after killing it. If the grasses not benefitted the grazing is predation interaction.

    In ammensalism one organism of association is harmed and second is not affected *e.g.*, antibiotics.

    In commensalism only one organism is benefitted and neither is harmed. There is no physiological exchange between these organisms.

12. Cytoskeleton is associated with cell motility. It is made up of three elements namely microtubules, micro filaments and intermediate filaments. Microtubules are formed of tubulin protein and help in chromosomal movement during cell division. Microfilaments are made up of actin protein and intermediate filaments are made up of keratin, vimentin and desmin. Microfilaments help in cell movement and in formation of cell furrow and cell plate.

13. Starch is the most important polysaccharide present as stored food in seeds, fruits and rhizomes of plants. It is made up of long chain of α–D glucose joined by α, 1 → 4 linkage.

    Inulin is made up of 30-50 fructose units mostly found in family-Compositae, *e.g.* Dahlia.

    Maltose is composed of two α–D glucose molecules and is found in corn syrup.

    Lactose is made up of one molecule of glucose and galactose and found in milk.

14. Photorespiration is a wasteful phenomenon found in C_3 plants only. The respiratory substrate is 2-C compound glycolic acid formed in chloroplast. During photorespiration due to high O_2 / CO_2 ratio RuBP carboxylase acts as oxygenase.

    Aerobic respiration is found in both C_3 and C_4 plants and synthesise ATP while no ATP is formed in photorespiration.

15. Herbs are plants which are non-woody and aerial parts are non-persistant. Their stem is short, delicate and green. In angiosperms the flower is present which develops into fruit, which are the store site of food.

    Root, stem and leaves are also store site of food but not in all plants.

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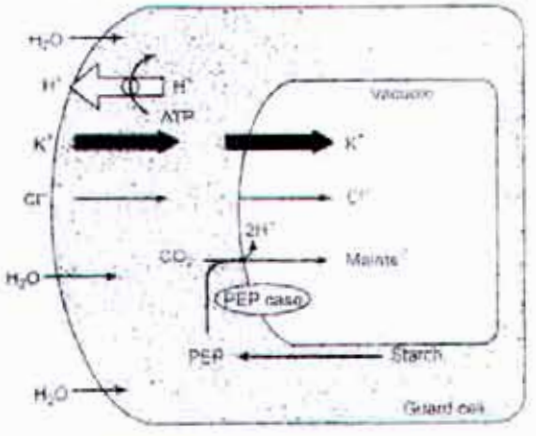
16. Light is the most important factor for photosynthesis because it is used as a source of energy. Photosynthesis occurs in visible part of spectrum, i.e. 380-760 nm. In monochromatic light maximum photosynthesis occurs in red light followed by blue light and poor photosynthesis in green light. Although it is maximum in polychromatic light.

17. The K^+ pump hypothesis for stomatal opening and closing was given by Levitt (1974). At the time of opening of stomata p^H of guard cells rises due to H^+ uptake by chloroplast or mitochondria. Raised p^H causes hydrolysis of starch to form phosphoenol pyruvate which combine with CO_2 to form oxaloacetate. The oxaloacetate dissociates to malate and H^+. With the help of cytokinin, ATP and cAMP, guard cells send out H^+ ions and absorb K^+ from adjacent epidermal cells. To counterbalance K^+ a lot of Cl^- are also absorbed.



18. At metaphase of mitosis the chromosomes become maximally distinct due to further contraction and thus size of chromosome is measured at metaphase. Due to attachment of spindle fibers at the centromeres of chromosome, the chromosomes are arranged in the centre or at equator due to their active movement. During prophase nuclear membrane and nucleoules disappear and each chromosome longitudinally splits into two chromatids.

During anaphase the chromosomes divide at the point of centromere and thus, two sister chromatids are formed. At telophase the sister chromatids reach opposite poles of the spindle.

19. DNA is helically twisted, double stranded polymer of nucleotides. The two polynucleotide strands of double helix run in opposite direction. The phosphate group link the 3' carbon atom of one sugar to 5' carbon of next in line, through a bond called phosphodiester bond.

Hydrogen bonds are formed between complementary nitrogenous bases.

Ionic bonds are formed between two atoms first having one or more extra and other having one or more less electrons in normal state.

20. Eutrophication is increase in amount of nutrients (organic matter) in water bodies. It leads to organic loading and depletion of O_2.

High concentration of CO_2 in air leads to green house effect

High concentration of Hg couses Minamata disease in fish

High concentration of nitrate and sulphate form HNO_3 and H_2SO_4 in rain water and called acid rain

21. Chaemoautotrophs are autotrophic bacteria which obtain energy from exergonic reactions of inorganic substances present in their environment and utilize the energy in synthesis of organic nutrients. Nitrifying bacteria (*Nitrosomonas, Nitrobacter*) are nitrifying bacteria.

Phototrophs are organisms which synthesize food in presence of light.

Heterotrophs are organisms which obtain food from outside sources.

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22. Due to heavy industrialization and transportation CO_2 concentration is increasing day-by-day. CO_2 has capacity of absorbing heat radiations and thus, increase temperature. This increase in global temperature is called global warming/green house effect. Other gases responsible for global warming are CH_4, NO_x, CFC_s and O_3.

23. The main source of mineral return to the soil is decomposed organic matter called humus. It is having high water holding capacity and makes the soil porous. Humus contains phenolic complexes, soluble proteins, soluble sugars, amino acids and organic acids.

The pores of sieve tube elements of phloem get plugged during winter with a substance called cellulose, hence transport of food is retarded.

Starch is a polysaccharide present as stored food in seeds, fruits and rhizomes of plants. It is made up of a long chain of α-D glucose units.

24. In the cell wall of bacteria two important sugar derivative N-acetyl glucosamine (NAG) and N-acetyl muramic acid (NAM) are present. In the cell wall of gram–ve bacteria either horizontal or vertical peptide linkage are present due to which mesh is loose and hence stain comes out. Further outermost layer of cell wall is made up of lipopolysaccharide.

The outer layer of cell wall of gram +ve bacteria is made up of teichoic acid.

The cell wall of plant cells is composed of cellulose while the cell wall of fungi is made up of chitin.

25. There are two generations in life cycle of bryophytes. The main plant body is gametophytic. The gametophytic phase starts with formation of spores,which generate bryophyte thallus. The antheridium (male sex organ) produces antherozoids and archegonium (female sex organ) produces egg, which undergo fertilization to form zygote. The sporophytic phase start with zygote and ends with reduction division in spore mother cells.

26. In symbiosis both the organisms in association are benefitted and this association is obligatory. The blue-green alga *Anabaena* reside in coralloid roots of *Cycas* for nitrogen fixation.

Commensalism is the association where only one organism is benefitted and neither is harmed, e.g. epiphyte.

Some microorganisms secrete few chemical substances which kill or inhibit other micro organisms. These substances are called antibiotics and the phenomenon antibiosis.

Parasite is an organism which live in constant association with host and gets its food directly or indirectly without killing the host.

27.

Type of fruit	Example	Edible part
Drupe	Mango	Mesocarp
Berry	Guava	Pericarp and placenta
Pome	Pear	Fleshy thalamus
Lomentum	Groundnut	Cotyledons and embyo lobe.

28. Rhizome is a branched, prostrate, horizontally growing stem having nodes and internodes. On the nodes sessile scale leaves are formed which bear buds in their axile e.g., *Zingiber officinale*.

Raphanus sativus (radish), *Daucus carrots* (carrot) are modified roots.

Leaf is the main photosynthetic organ of plant.

29. Clone is an asexual progeny of the individual. They are produced through tissue culture methods.

Crossing over takes place during pachytene stage of meiosis which causes origin of variations.

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Recombination leads to formation of new combination of genes that are also cause of variation.

Mutation causes change in genetic material which may be beneficial or harmful and spontaneoues or induced.

30. Analysis of plant ash shows that about 92 mineral elements are present in different plants. Out of these 16 elements are necessary for plants and are called essential elements. These are divided into two main groups.

(i) **Macro elements**

E.g., C, H, O, N, S, P, K, Ca, Mg.

(ii) **Micro elements**

E.g., Fe, Cu, B, Zn, Mn, Mo, Cl.

31. When a new species enters into ecosystem due to limited resources there occur competition among organisms and species. The competition among individual of same species is more harmful.

Symbiosis is the association in which both the organisms get benefitted. This is mostly obligatory.

Introduction of new species in ecosystem is beneficial for better development of strong species, *i.e.*, one or more species may be harmed and the remaining one shows better development.

32. The reactions releasing energy are called exergonic or exothermic while the reactions or systems absorbing energy are called endothermic or endergonic, *e.g.*, photosynthesis.

33. Coenzymes are non-protein organic cofactors which only loosely attached to apoenzymes during the functioning of holoenzymes, *e.g.*, NDA^+, $NADP^+$, CoA, TPP, FMN, FAD.

Inorganic ions especially metals are required for the activity of over 25% of total enzymes.

Simple enzymes are entirely made of proteins. The complex enzymes (called holoenzymes) are composed of protein part (apoenzyme) and non-protein part (called cofactor).

34. **Linnaeus** not only laid the foundation of taxonomy but also introduced binomial nomenclature.

Binomial name consists of two parts, the first is the name of the 'Genus' the second called the 'specific epithet' identifies the particular species within the genus.

Linnaeus, adopted the **artificial system of classification**.

George Bentham and **Joseph Dalton Hooker** proposed the **natural system of classification** of plant kingdom.

Julian Huxley (1940) proposed the term '**new systematics**' which takes into consideration all the known characteristics of organisms.

35. The vacuole is lined by a membrane called **tonoplast**.

Jacket layer is present around archegonia and antheredia in bryophytes.

Tonoplasm is the content or liquid present inside the vacuole enclosed by a tonoplast membrane.

Cell membrane is the semi-permeable membrane enclosing the protoplasmic material of a cell.

36. *Gelidium*, *Gracilaria*, *Pterocladia* are red algae having industrial importance. They produce a jelly like substance agar-agar, used as culture medium with a number of different uses.

Chlorella, a green alga contains 50% protein, vitamins. Antibiotic chlorellin has been extracted from *Chlorella*, found to be more effective against bacteria.

Spirogyra, a green alga is also known as water-silk.

37. After certain years of growth, the xylem elements of the stems of a number of trees develop dark brown colouration, especially in the central or innermost layers. This region comprises dead element with highly lignified walls and is called heart wood or duramen. It is present in inner region of secondary wood.

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38. Photochemical smog occurs at high temperature over cities and towns due to still air, emission of nitrogen oxides and hydrocarbons from automobile exhausts and solar energy. Nitrogen dioxide splits into nitric oxide and nascent oxygen. Nascent oxygen combines with molecular oxygen to form ozone. **Ozone** reacts with hydrocarbons to from aldehydes and ketones. **Nitrogen oxide**, **oxygen** and **ketones** combines to from **Peroxy Acyl Nitrates** (PAN) which is responsible for the eye irritation. This smog was first observed in Los Angeles, so called as Los Angeles smog.

Classical (London) Smog was reported in 1952 in London. It occurs at low temperature, contains sulphur gases (hydrogen sulphide, sulphur dioxide), smoke and dust particles.

39. Soil transportation by wind is common in dry region where soil is chiefly sandy and the vegetation is very poor. Transported soil are those where the weathered material is taken away at other places. Depending on the nature of these transporting agents the transported soil may be

(i) **Glacial** transportation by glaciers (large mass of snow ice).

(ii) **Eolian** transportation by wind.

(iii) **Alluvial** transportation by running water.

(iv) **Colluvial** transportation by gravity.

40. The occurrence of relatively definite sequence of communities over a period of time in the same area is known as ecological succession.

Lithosere is a type of xeroseres originating on bare rock surfaces. The original substratum is deficient in water and lacks any organic matter having only minerals in disintegrated unweathered state. The pioneer vetegations, therefore lichens.

Hydrosere originating in a pond starts with the colonization of some phytoplankton which form the pioneer plant community.

41. **Microsporophylls** and **megasporophylls** are the leaf-like structures on which microsporangia (pollen sacs) magasporangia are borne on the same plant of *Pinus*. The sporophylls are aggregated in form of cones.

(a) Male cones are smaller, also known as microstrobili (staminate strobili).

(b) Female cones are larger, known as macrostrobili (ovulate strobili).

Each male cone consists of an elongated axis, bearing a number of spirally arranged **microsporophylls**. On the underside of which two microsporangia develop and get filled with microspores (pollen grains).

Anther or **microsporangium** is the male reproductive structures of **angiosperms**. Microsporangium forms microspores (pollens), through microsporogenesis.

Ligule is a tongue-like membranous outgrowth, present on upper surface, near the base of the microphyllous leaf in pteridophytes (*e.g.*, *Selaginella*). The ligule shrinks and becomes inconspicuous in mature leaves.

42. **Sporopollenin** is a polymer, tougher than lignin but with similar properties, composed chiefly of carotenoids makes spores and pollen grains of plants resistant to biodegradation is the hardest plant product.

Lignin is the main component of secondary walls and wood of plants, composed of phenylpropanoid units which provide a right matrix for cellulose fibres.

Cutin is a transparent waxy substance constituting, together with cellulose, the cuticle of plants.

Suberin is a wax like fatty substance, occurring in cork cell wall and in between other cells, that on alkaline hydrolysis yields chiefly suberic acid.

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43. 'Clamp connections' are observed in Basidiomycetes (club fungi). During nuclear divisions of the dikaryotic cell, special structures called the **clamp connections** are formed. These **clamp connections** ensure that the sister nuclei of the dikaryon, at each division, separate into daughter cells.

Torula stage of fungus is observed in **Zygomycetes**. In zygomycetes the zygospore germinates to produce a hypha, the promycelium with terminal sporangium.

In Oomycetes one of the flagelium is of tinsel type and the other of whiplash type. The hyphal wall chiefly consists of β glucans and cellulose and not chitin. The mycelium is extensive and coenocytic.

In Ascomycetes the spore of sexual stage (meiospores) which are known as the ascospores are endogenous in origin. They are produced within sac-like structures called asci which vary in shape.

44. **Transpiration pull** is the tension which develops due to transpiration. It has been demonstrated and evidenced, that rate of water absorption and hence, ascent of sap closely follows the rate of transpiration and hence, ascent of sap closely follows the rate of transpiration. **Cohesion and transpiration** pull theory, given by Dixon and Jolly (1894) is the most accepted theory for ascent of sap.

Root pressure theory (Priestly; 1916) is a manifestation of active water absorption. It was objected, as it has not been applicable to all plants (e.g. gymnosperm ous tallest tress). Moreover, this pressure is low to raise the sap to the top of trees and also many reasons which this theory was unable to proove.

Pulsation theory or **vital force theory** (J C Bose 1923) was also discarded because living cells do not seen to be involved in the ascent of sap as water continuous to rise upward in the plant in which ce ls have been cut or living cells of stem are killed by poison and heat (Stressburger; 1891).

Capillarity theory (Bohm; 1863), laid stress on capillarity movement of water due to adhesion and cohesion forces balanced by downward pull of gravity. It was also discarded, as the value of capillary is too small and applicable only to small sized plants and tall plants with narrow vessels.

45. Gymnosperms (*Gymno* = naked + *sperma* = seed) are naked seeded plants in which ovule is not covered by ovary. In gymnosperms, xylem contains only tracheids and xylem parenchyma; vessels are absent (exceptionally present in Gnetales).

46. The presence of diversity at the junction of territories of two different habitats is known as edge effect. In other words, the potential for the ecotone to act as habitat for species found in neither major community is called edge effect. In actual, the transition zone between two or more diverse communities is called the ecotone, the population of which becomes more adapted than both the major communities (communities of neighboring habitats) which are too simple. In addition to this, in this region the density of most of the species is higher than in the neighboring.

47. As per 'ten percent law', in an ecosystem, all energy is provided by sun through photosynthesis. All of the energy stored by the autotrophs in the form of food is available to the herbivores as food. Herbivores can stored only 10% of this energy in their biomass and 90% is used in life activities. In the same way, herbivores are eaten by carnivores and carnivores by top carnivores. Thus, only 10% of energy is captured by the organisms of next higher trophic level.

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48. The shape of the chromosome is determined by the position of centromere on the chromosome.

Chromosomes may be of following five types on the basis of their shape.

(i) **Acentric**—Centromere remains absent.

(ii) **Telocentric**—Centromere present at one end of chromosome.

(iii) **Acrocentric**—When chromosome is divided into a very small segment at one end and a very large segment on the other end.

(iv) **Submetacentric**—When chromosome have two unequal segments, one of which is slightly larger that other and forms L-shaped chromosome.

(v) **Metacentric**—When two segments are equal and forming V-shaped structure.

49. As we know that bacterium divided after every 35 minutes through simple mitotic division therefore, number of divisions are

$$\frac{175}{35} = 5$$

Since, one bacterium on division produceds two cells so, cell concentration after 175 minutes will be

$$= 10^5 \times (2)^5$$

$$= 32 \times 10^5$$

50. A species can be defined as a group of closely related organisms which are capable of inbreeding to produce fertile offspring. Thus, biological concepr of species is mainly based on reproductive isolation, which preserve the integrity of the species by checking hybridization.